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1610

*Præcepta*

first English translation very scarce

Cortes (M)

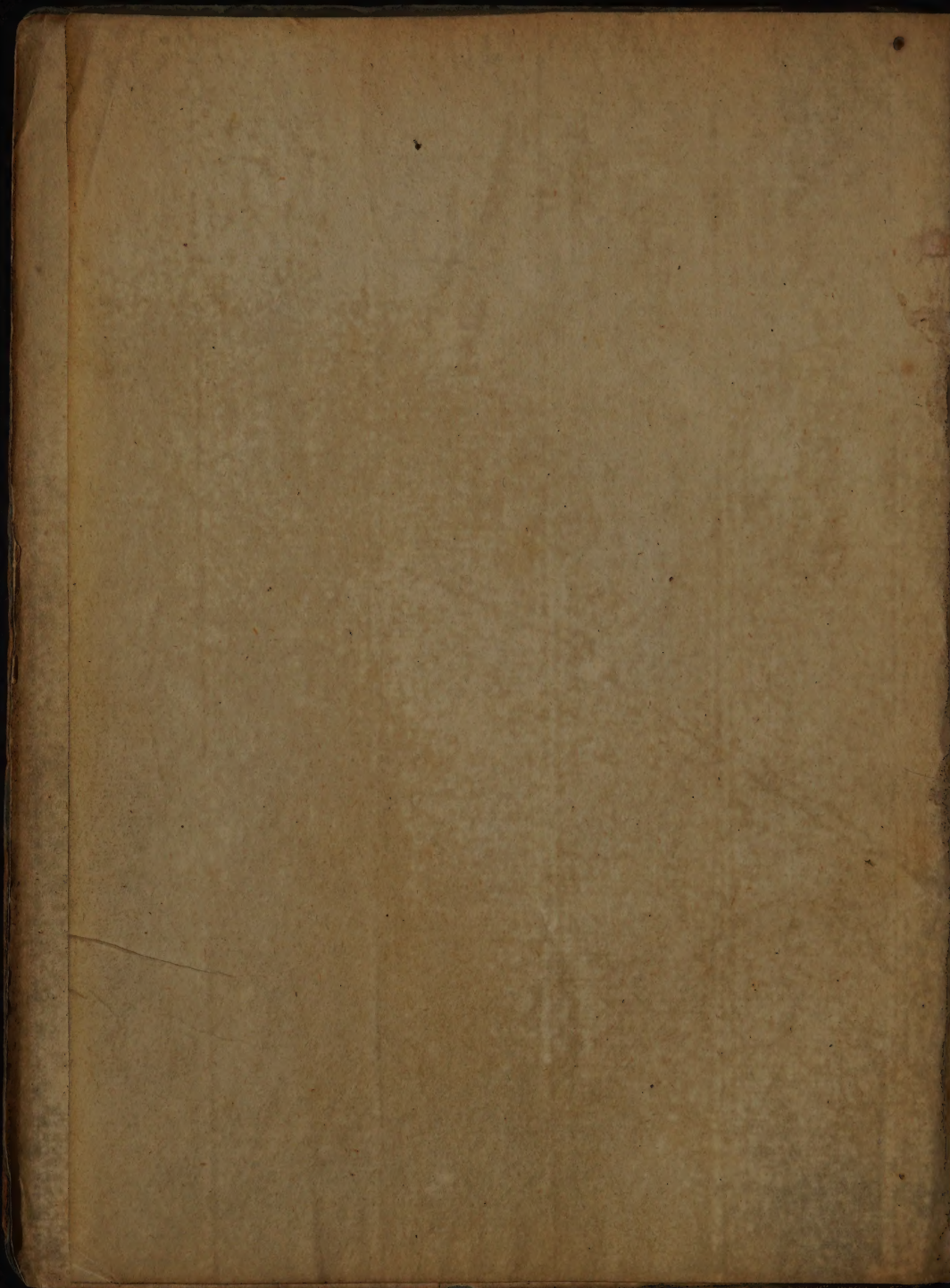
The Art of Navigation  
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To the ryght worshypfull syr VVyllyam Garrerd

Knyght, and Maister Thomas Lodge,

Aldermen of the Citie of London, and Couer-

nours of the honozable felowshyp or societie,

as well of certeine of the Nobilitie, as of

Marchauntes aduenturers, for the disco-

uery of Landes, Territoies, Flan-

des, and Seignozies vnknowen,

and not befoze their first aduen-

ture or enterpise by Seas or

Pauiuations commonly

frequented:

And to the right worshypfull the Consulles,

Ambassantes, and comminalltie of the

same societie, Richarde Eden

wyssheth health and

prosperitie.



What soeuer he was (ryght ho-  
norable and worshypfull) that fyrste  
beleued that the frame and coaptacion  
of the bodye of man, with the functi-  
ons, offices, and duties of the partes  
and members of the same, knytte to-  
gether in a certen vnitie to a common  
ministracion, dyd represent a lyuely

Image and similitude of a perfecte common wealth: I  
thynke that he was a man of no bulgare iudgement or  
abiecte mynde, but rather of singuler wysdome and pru-  
dence in the contemplacion of Diuine and humane thyn-  
ges. For he sawe, that as in the small natue seede of  
all growyng or lyuing thinges, is conterned the fourme  
that byyngeth them to theyr perfection: so in certeyne  
small and obscure members of the common wealth, con-  
sisteth no small increase to the perfection of the whole.  
He sawe lykewyse that herein, as in the bodye of man  
representyng the partes and members of the woelde (as  
I haue sayde) are dyuers partes of dyuers and sundrye  
actions and motions, greatly dyfferyng in fourme, num-  
ber, and



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ber, and quantitie, yet all the same to be so knytte together, and so to consent in one vniformitie to the common profite of the whole, that a greater concord and harmonye can not be imagined, then is proportioned by the frendly vnitie of dyuers and contrarie. We saue lyke wyse in the same, such a mutuall compassion of parte to parte, and member to member, by one common sence existent in them all, that no one part or member can feelee yther ioye or payne, but that in maner all the other are parttakers therof more or lesse, yf they be lyuely members, and not wythered or otherwyse vnensate by reason of dead fleshe, which onely by cutting and burning ought to be deuyded from the sounde and whole. But as in man (whom Plato calleth the lesse world) the vigour and agilitie of the immortall soule and mynde, neuer ceaseth from continuall mouyng, but is euer exercised in excogitations and inuentions of great thinges (here in resembling God, whose caracte it beareth) by prouidence foreseeing, and by intelligence vnderstandyng and deuyng what is to be done, and what to be eschewed, doth immediatly moue & rapte vp the faculties, powers, and members of the body to execute the same: Euen so in the greater worlde, the prouidence of God, and vniuersall counsayle and consent of men, hath elected and appoynted certen principall men, to beare lyke rule and auctoritie in the bodye of the common wealth, as hath the intellectuall soule in the members of our bodye to moue and commaunde the same. So Princes therefore counsaylours, rulers, gouernours and magistrates, as to the most intellectuall and sensitiue partes of the societie of men, hath God and nature geuen preeminence & gouernance of the common wealth, that by theyr prouidence, wysdome, and ayde, it may vniuersally floreysh, not onely by iuste administration of good lawes, with due correction of malefactours, but also by lyberall rewarpyng of suche as haue well deserved: and especially by maintenaunce of suche artes and sciences, as the common wealth can not well be without. And to draw  
nearer



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hearer to the applyinge of my similitude : I saye, that whatsoeuer vertue, whatsoeuer arte, or the ingenious industry of men hath to this day inuented, all the same is to be imputed to the beneuolence and liberalitie of suche as haue honourablye maintayned and freelye rewarded the trauayles, paynes, and charges of them that haue spent theiꝝ lyues, goodes, and wyttes (as many haue done) in the inuentions of necessarye and profitable artes and sciences. For euen as hollesome and temperate ayre with seasonable wether and fauorable influence of the heauens and planettes, causeth fructefulnes on the earth, and contrarywyse, barrenesse by the contrarye : Euen so the fauour of Princes and Magistrates nourisheth, augmenteth, and amplyfeth all artes and sciences by liberalitie, and extynguisheth the same by miserable couctousnes and parcimonie. And although in some men of rare and noble nature, the desyre of honour and fame onely for vertues sake, and study toward theiꝝ countrey and common wealth, hath moued them in maner to theiꝝ owne vndoing through theiꝝ greatesse losse and hynderaunce, to sette forth and inuent diuers thynges for the commoditie of the common wealth and other, rather then for theiꝝ owne: yet vndoubtedly, who so wel considereth and indifferently wayeth that I haue sayde, shall fynde and see by daylye experience, that in maner onely munificence, liberalitie, and rewarde, or the hope thereof, geueth spurres to them that attempte great and vertuous enterpryses, as I coulde more largely proue by so many testimonies of Hystories, both holy and prophane, that the rehearsall therof shoulde be but tedious and not greatlye necessarye for my purpose, especially wytyng vnto your honoures and worthys, of whose munificence and liberalitie, I haue had great experience, bothe in my selfe and others, who by your ayde and mainteynaunce haue attempted and perfourmed many goodly inuentions, viages, navigations and discoueries of landes & Seas heretofore vnknewen.

¶ Therin

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Wherein, what great charges you haue suffeyned, and howe lyberall and constant you haue ben in furtherynge the same, doth well declare that hytherto you are rather losers than gayners therby. The whiche thyng doubtlesse is the more to your commendation, in that it maye hereby appeare that you haue attempted the same rather for knowledge and vertues sake, then for conetousnes of gaynes: as is furthermore well knownen by your fyrste viages of discouerye attempted to Cathaye by the Northeast seas, vpon certen losse and detriment, for vncerteyne hope eyther of gaynes, or of any such way to be founde, otherwyse then by certen lykely coniectures: not muche vnylike to the thynnyng fflowes of Marchasites, which outwardly appearing in minerall mountaynes, are signes and token wherby is coniectured what metal is conteyned therein, and whether the same is to be folowed or not. And although it sometyme so chaunce that such signes are fayneable, shewyng more in apperaunce then they conteyne in substaunce: yet are not such signes tokens, or shewes to be contemned, but rather earnestly to be folowed, forasmuch as it hath ben often proued and founde by experience, that by folowynge the same, haue ben founde great and riche mynes of metalles: as Georgius Agricola in his bookes De rebus metallicis, doth largely declare and proue by manye examles. But to wyte at large what greate thynges haue proceeded of small and obscure begynnings, and in maner mere coniectures: it woulde so farre exceede the measure of an Epistle or Preface, that it woulde rather increase to the iust quantitie of a booke. For in maner all the late discoueries both of the Spanyardes & Portugales, had they begynnynge of such small coniectures, with vncerteyne hope (as it were *preter spem sub spe*) vntyll God and good happe, by the constant trauayle and valiant mynde of such as fyrst attempted the same, gaue them to enioye that they hoped for. But whatsoeuer they haue obteyned and do enioy, this may I boldly say in your behalf (right honozable and woorthypfull) that there hath not lacked in you eyther the lyke or greater promptnesse of mynde, forward-



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forwardnes in attemptyng, magnificence in expences,  
and liberall in rewardes. For besyde the great charges  
and losses that you haue ben at other wyse, what should  
I speake of the great gyftes that you haue sente to the  
Emperour of Russia: What of your last chargeable vy-  
age of discouerye among the innumerable Rockes, I-  
landes, and moueable mountaynes of Ice in the frozen  
sea, by innumerable landes and Ilandes vnknownen to  
the Antiques, euen vnder and farre within and beyonde  
the circle Arctike, where they thought that no lvyng  
creature coulde drawe breath or liue for extreme colde:  
wheras neuerthelesse the same hath ben by you discou-  
red euen vnto the myghtye ryuer of Ob, that falleth in-  
to the Scythian Ocean, or Oceanus Hyperboreus, not farr  
from the mountaynes called Hyperborei, so named be-  
cause they are situate almost vnder the North pole, and  
thought therfore to be inaccessible. A vyage doubtlesse  
of such difficultie and in maner impossibilitie, that con-  
syderyng the infinite daungours therof (as I haue lear-  
ned by thinformacion of Steuen a Burrough, that was  
then the chiefe Pilote of the same vyage) it may seme im-  
possible that they shoulde euer haue escaped, excepte the  
myghtye hande of God, by the experte skylfulnesse of so  
excellēt a Pilot, had delyuered them from those daun-  
gers. And although in dede (as religion byndeth vs) it  
is conuenient in all thynges to geue all honour, glozve  
and thanks to God, yet are we not thereby restrayned  
to be thankfull to such men, as by theyr arte, ingenious-  
nes, trauaile, and diligence, haue deserued both iuste  
commendation and large rewarde. And therfore refer-  
ryng the rewarde to you (ryght honozable and woorthy-  
full, to whom it apperteyneth) yf I should not here geue  
hym at the leaste suche commendation, as in my iudge-  
ment he hath well deserued, I myght seme both to de-  
fraude hym of his woorthye desertes, and also to forgette  
the frendshyp and good wyll I beare hym, onely for his  
vertues and excellencie in his profession. For certepnly  
when I consider how indigent and destitute this Realme  
is of excellent and expert Pilottes, I can do no lesse of  
conscience



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conscience, then in respect of your owne commoditie, yea rather for the commoditie of the Queenes Maestie and the whole Realme, to exhorte you and put you in remembrance (although I may herein seme to put the spurre to a runnyng horse, as saith the Proverbe) so to regard hym and esteeme hym and his saythfull, true, and painefull seruice towarde you, that he maye thereby be further encouraged, and not discouraged, eyther for lacke of maintenaunce, or other wyse by the iniurious assaultes of such his enemies, as onely his vertues and excellencie haue moued to beare hym displeasure, as enuye doth euer folowe vertue, as saith the Latin Proverbe, Virtuti comes inuidia. And howe true a sentence this is, is well verified by the saying of a certayne Philosopher (whose name I do not remember) who hearynge one baynely reioyce that he had no enemies, aunswered that that was a token he hadde done lyttle good: Meanyng thereby (as dayly experience proueth) that yf he had excelled in any vertue, he coulde not haue lacked some enemies. And hauyng here touched to speake of enuye, I remember that when I was a yonge scoler, I haue read in the Poet Hesiodus of two kyndes of enuye, whereof the one is called Inuidia, and the other Aemulatio, which is more tollerable then the fyrste, for that it is ioyned with some vertue, and enuyeth that anye shoulde excell hym in any excellent qualitie that he professeth. But forasmuch as this enuy of emulation procedeeth of some singuler vertue of them that are so maliced, they maye herein reioyce, that they shall euer haue a hundreth frendes for one enemy: yea and although they hadde none, yet is vertue a rewarde to it selfe, and to be embraced for it selfe onely, as the Philosophers affirme. What then shall we say to such, as forgettyng this rewarde of vertue, do not onely fauour, but rather hynder the preferment and mayntenaunce of such experte men, more esteemyng certeyne Fythermen that go a trawlyng for fysh in Catches or mangers, and dradgies for Wyllers about the sandes, betwene the South furlande

and

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and Wynterton nelle, and the landes about Temmes mouth, then they do suche excellent Pylotes as are able without any Rutter or Carde of Nauigation, not onely to attempte longe and farre viages, but also to discouer vnknown landes and Ilandes, as haue doone of late yeares many excellent men, to the great honour and enrychynge of their Prynce and countrey. But as touching Steuen A Bzrough, the chiefe Pylote of your viages of discouery, it may hereby well appeare y he is neyther malicious nor enuious of his arte & science, in that he desireth y same for the comon profite to be comen to al mē: And for the same intent was the fyrst that moued certain woorthypfull of your company, as Syr William Garred, Maister William Pericke, Maister Blase Sanders, and Maister Edward Castlen, to haue this worke translated into the Englyshe tongue. Who of their own good nature fauourynge al vertuous studies and the professors of the same, did sone incline to his honest request herein: and therewith not only desired me, but also with liberall rewarde entertained me, to take in hande the translation. Whiche being nowe finished as well as my pooze learnynge may perfourme, I desyre your honours and woorthyppes, to accepte in as good parte as I haue ment herein to gratifie you, and doe suche seruice as my abilitie may suffice. Howe therfore this worke of the art of Nauigation, beyng publyshed in our bulgar tongue, you may be assured to haue more store of skylful Pylotes. Pylotes (I saie) not Pirottes, Rulers, not Routers, but suche as by their honest behauour and conditions toynded with arte and experience, may doe you honest and true seruice: whiche is not to be looked for of suche as beyng destitute as well of the feare of God as of all mozal vertues, superbounde in all notozious vyces, accompting desperatnesse for boldnesse, rashnesse for hardinesse, impudencie for stoutnesse, and crueltie for manhod. What other thynge (I saie) is to bee looked for of suche, then of suche trees suche frutes, Et mali corui malum ouum. But

CC. i. for as



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for as muche as these haue no place appointed them in the bodie of our common wealth, whiche we haue here befoze compared to the members of the bodie of man: therefore are they no otherwyse to bee esteemed then as excrementes of the bodie, to whom nature hath appointed no place in the same, but laboureth continuallye to cast them forth dyuers wayes, leasse by theyr filthynesse they should infecte the other members, euen as the pompe of the shyppe if it be not auoyded, is noxious to the shyppe and all that are therein. But the wyse and honest Pilot, fyrst hauyng befoze his eyes the feare of God, and puttyng his chief trust in hym, shall secondarely trust to his arte and science, without any suche wayne obseruations as the superstitious Horoscopers (Astrologiers I meane, and not Astronomers) are accustomed to vse in the elections of houres, tymes, and dayes, by constellations and aspectes of the Starres and Planetes, as many sonde menne haue doone, thynkynge thereby to haue escaped suche daungers, as they haue thereby the rather fallen into, throughe contempte of arte and science by folyshe confidence in superstitious Astrologie: which for the vanitie and vncertaintie thereof, the ryght woorthyfull and of singular learnynge in all sciences, Syr Thomas Smyth, in my tyme the floure of the Uniuersitie of Cambridge, and sometyme my Tutor, was accustomed to call Ingeniosissimam arte mentendi. (That is) the moste ingenious arte of lpyng. Omitting therefore the superstitious and phantasticall obseruations of the iudicials of Astrologie, it shalbe better and more necessary for all Pilotes that desyre to excelle in theyr profession, to learne and obserue the principles of this booke, whereby they may haue suche knowledge of the Sphere, as may instructe them the makynge and vse of dyuers goodly Astronomicall instrumentes pertynyng to the arte of Nauigation, by knowledge of the mouynges of the Sunne and Moone in their Spheres, and the other Planetes and sixte Starres: thereby to attayne to the true knowledge of houres, tymes & tydes, with the variation of the Compasse, and many other goodly naturall obser-



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observations of weathers, tempestes, & calmes, by certain infallible signes and tokens of the same, very necessary to be obserued. And this by the true principles of Astronomie and not of Astrologie. And this is the true Astronomie wherof the Diuine Philosopher Plato hath written so diuine a sentence, that I haue thoughte the same here worthy to be alleaged, that by the auctoritie of so famous an aucthour, we maye knowe what is true Astronomie, with the vse and commoditie therof. Therfore in his booke intituled Timeus vel De Natura, these are his wordes. *Rerum autem optimarum cognitionem, nobis oculi attulerunt. Nam hæc quæ de mundo disputantur, nunquā inuenta fuissent, si neq; sidera, neque Sol, neq; Cœlū, suspici potuisset. Cognitione vero diei ac noctis, ab oculis orta, fecit ut diuensione quadam, mensuram ænorūq; ambitus metiremur, tempus cognosceremus, ac vniuersæ naturæ ordinē scrutaremur. Quibus ex rebus, philosophiā adepti sumus.*

That is to saie. Our eyes haue brought vnto vs the knowledge of moste excellent thinges. For what so euer is disputed of the worlde, had neuer bene inuented, yf neither the Starres, neither the Sunne, neither heauen, coulde haue bene seene. For the knowledge of the daye & nyght, takyng beginning at y eyes, caused vs as it were by certen limites and boundes to measure the circuites of monethes and yeares, wherby we came to the knowledge of tymes and the order of vniuersall nature. And hereby also we obtayned the knowledge of Philosophie. &c. And thus by the auctoritie of Diuine Plato (whome for hys excellencie Cicero called *Deum Philosophorum* (that is) the God of Philosophers) we maye vnderstande that the true Astronomie, is the perfecte knowledge of the miraculous mouinges of y Planetes, Starres, and heauens (and especially of the Sunne and Moone) whereby is caused the varietie of times and diuersitie of all naturall thynges, by naturall causes: as by the qualities of Elementes, as hoate, colde, moyste and drye, whyche are augmented or dymynished by the more or lesse influence of these twoo Luminaries, as they comine nearer vnto vs at some tymes, or de-

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part further from vs at other tymes, with diuers motions in diuers climates whiche causeth not onely varietie of tymes in sundry climates, but also the varietie of diuers complexions, formes, and dispositions of all creatures vnder the face of heauen, none other accidentall contingent, volūtarie or violent cause to the contrarie notwithstanding. And this is it that Plato meaneth by those wordes. Vt tempus cognoscereinus ac vniuersæ naturæ ordinem. &c. That is, to knowe the tymes and vniuersall order of nature. And doubtlesse, who so well considereth the marueilous effectes that are caused, especially by the variable mouing of the Sunne in the Zodiac, must needs acknowledge it to be the chiefe instrument & meane that God vseth in the generation, preservation, and alteration of all creatures that are conteyned in the worlde of generation and corruption. And for this consideration, certen of the auncient Philosophers called it the soule of the worlde: Other the eye, and other also the heart of the worlde. Plato also affirmeth that the soule of the worlde is in the Sunne: And that all other liuing thynges, receiue lyfe from thence. And hereof commeth the sayinge of the Philosopher, Sol & homo generant hominem: (that is) the Sunne and man, begette man. And therefore (as wyrteth Marcilius Ficinus) of all Idolaters they are most tollerable that honour the Sunne for God. The whiche although it bee not, yet vndoubtedlye are his effectes so greate and wonderfull in this inferiour worlde, that it may seme in maner to be Gods Vicegerent, Lieutenant and Viceroy in al the woorkes of nature, excepte where and when it please hym in any thyng myraculouslye, otherwyse then by the common order and course of nature, to commaunde the contrarie.

And yf it may not be tedious vnto you (ryght honorable and woorthypfull) it shalbe a pleasure vnto me, for the better declaracion hereof, to make a bryefe discourse of the marueilous and straunge effectes that are caused by the Sunne: whiche perhappes se we haue done, otherwyse



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Wpse then dispersedly here and there, as occasion hath serued. Fyrst therfore let vs consider what it hath done ouer the Equinoctiall line, and vnder both the poles at one instant, yet diuersely and contrarely the one to the other. For so hath the infinite wyledome of the greate God of nature, the supreme Architecture of the vniuersall worlde, disposed all thynges in such perfecte order, that to them that are vnder the Equinoctiall, and haue theyr Horizon passyng by the two Poles, the daye is of xii. houres and the nyght as much, and theyr yeare also is deuyded into. xii. monethes: But they that dwell iust and perpendicularly vnder our pole, and that haue their Horizon passyng ouer the sayde line, haue the daye of syre monethes. That is to saye: begynnynge from the tenth daye of Marche, when the Sunne commeth ouer the sayde Horizon, vntyll it returne to passe vnder the same at the tenth of September. And contrarywys one nyght of syre monethes haue thynhabitauntes vnder the Pole Antartike: whose yeare (that is to saye, all the course that the Sunne maketh by the. xii. signes of the Zodiac) is accomplished in one daye and one nyght. A thyng doubtlesse moste wonderfull and marueylous. Lykewyse, when we haue Sommer, they that are vnder our Pole haue the day of syre monethes, and they of the opposite or contrary Pole, haue theyr nyght of the same length. Agayne, when it is wynter with vs, then vnder our Pole is the nyght of the sayde syre monethes: & vnder the opposite Pole, is the day of the same length. So that as it were course by course, when we haue the night, they haue the day: And contrarywys, when we haue the day, they haue the nyght. The which although it be so longe and of so great space of tyme, yet is it not continuallye obscured with darkenesse. For the Sunne maketh his course in such order, that the inhabitauntes of that parte, lyue not durynge that tyme altogether in darkenesse, as Moles lyue vnder the grounde, but as other creatures that lyue vpon the globe and face of the earth,



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earth, they haue suche lyght as maye suffice to sustayne and mayntayne theyr lyfe. For the bodye of the Sunne declineth no more eyther beneath the Equinoctiall line, eyther aboue the same line (which is the Horizon to both the Poles) then. 23. degrees: That is to saye, no lower or hygher then the Tropikes, whiche are no more then 23. degrees or there about from the sayde Equinoctiall that is the Horizon, as is aforesayde. And yet in these 23. degrees he maketh not his course by the opposit Diameter, but goeth continually rounde about in circuite: so that his beames reuerberatynge heauen, represente suche a manner of lyght, as we haue in Sommer two houres before the Sunne ryse. And this example which we haue taken of the diuersitie of the Horizons of the Equinoctiall and vnder the two Poles, is to demonstrate the marueylous effecte that the Sunne maketh departynge from the. xii. houres of the Equinoctiall (that is to say, from Aries to Libra) and commynge by lyttle and lyttle, illuminatynge the globe of the earth, and so reducepynge the yere of. xii. monethes, into one onely day and one nyght, as is sayde before. Vnder the infinite varietie of the which course, sometyme with long dayes and sometyme with shorte, all the inhabitauntes of the worlde are fourmed and disposed of suche complexion and strength of body, that euery of them are proportionate to the Climate assigned vnto them, be it hotte or colde: And may dwel & abyde there, as in their natural place and temperament, not lamentynge or despyng to dwell elsewhere, so greate a loue resteth in them to their natine situation. But not to departe from the byage whiche the Sunne maketh in one whole yere, as sometyme appoachynge neare vnto vs, and sometyme departing from vs. I saye that at one selfe same tyme in diuerse partes vpon the rounde globe of the earth, it causeth the Sprynge, Sommer, Autumne, and Wynter. And neuer thelesse at the same instant and punct of time it maketh day and high noone in one place, and nyght at mydnyght on the opposite part. The which varietie although

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though it appeare incomprehensible to the slenderesse of our wittes, yet beholdynge the same with the eyes of vnderstandyng, and therewith consyderyng the vnestimable mouyng that the Sunne maketh continually, we shall fynde it to be true, hauyng respecte to the dyuers situations of the earth, as it is continuallye illuminate moze or lesse by the Sunne. And this varietie is made with such a Harmonye and consonancie, and such a lawe perpetuall and immutable, that yf any poynt or ptecke therof shoulde fayle, it is to be doubted least the elementes shoulde be confounded together, and retorne to their fyrst Chaos.

And to haue sayde thus muche of the wonderfull effectes of the course of the Sunne, it maye suffice for an example to proue howe necessary a thyng it is, not onely for all Pilottes and Sea men to haue the knowledg hereof, but also for all other such as shall attempt great and farre viages in vnknown landes and straunge countreys, as dyd of late master Jenkynson a worthy gentleman, sette forth by you and mainteyned at your charges, moze lyke an Ambassatoure sente from auyce Prince or Emperour, then from a compaignie of marchant men. Wherein, what commendation you haue deserued, to the encrease of your perpetual fame and honour, I referre it to that I haue sayde befoze. And as touchyng master Jenkynson, what trauayles, paynes, and daungers he hath susteyned, and hardely escaped, and what diligence and art he hath vsed in the searching of straunge countreys, and in the description of those his viages, it were but in vayne for me to wyte much vnto you, vnto whom the same is better known then to me. And therfore to conclude, with rendyng iust commendations both vnto you and him, I can say no moze, but as Plato wyrteth in his booke De Legibus. Decens est eos ciues laudibus ornare, qui corporis vel animi viribus, res arduas preclarasq; gesserunt, & legibus libenter paruerunt. What is to say: It is decent to commende those Citizens that by theyr industry of bodye or mynde, haue done greate saydes, and haue wyllyngly obeyed good lawes.

And



The Preface.

And thus effsones desyring your Honours and Ma<sup>ties</sup>  
shyppes to accept in good parte whatsoener I haue saide  
of good wyll and affection towarde you and your pro-  
ceedynges, and with your shielde of Justice and  
auctoritie, to defende me agaynste the as-  
sautes of such as are enemies to  
vertue, and captious of  
other mens doinges:

I rest at your  
commaun-  
dement  
to the vttermost of my power, to  
do you what service  
I maye.

( )

# THE EPISTLE DEDICATO.

rie of Martin Cortes, to the moste mightie  
and victorizous Monarch Charles the  
Emperour, the fyfte of that  
name, Kyng of  
Spaine. &c.



**S**o greatly were esteemed thineuen-  
tours of certen artes and sciences in aun-  
cient tyme (as wyrteth S. Augustine in  
his bookes De ciuitate dei) that they tooke  
them not for moztall men, but honoured  
them as immoztall Gods. His arryuyng

The first in-  
uentours of  
artes.

3ms.

in Egypt, ordeined common wealthes with iuste gover-  
naunce, gaue them lawes and knowledge of letters: &  
taught them also the vse of Flare. In consideration  
wherof, she was honozed of such as then knewe her, &  
reuerenced of them that came after her: In so much,  
that they established a capitall penaltie or punishment  
of death agaynst all such as eyther in sport or in earnest  
affirmed her to be an earthly woman, and not rather a  
diuine Goddesse. Ceres being of lyuely wytte & cleare

Ceres.

vnderstandyng, beholdyng in the Cicilians humaine si-  
militude and shape to the outwarde apparence, and in-  
wardly the fiercenesse of brute beastes: bydeled theyr  
customes, and reformed them with newe statutes, tea-  
chyng them to tamie Oren to beare the yoke, to sow  
wheate for theyr great commoditie, to grynde in the  
myll, to kneade in the house, and to bake in the ouen.

The Cicilis-  
ans.

In recompence wherof, they made sacrifice vnto her, &  
builded many sumptuous temples in honour of her. Sa-  
turnus comyng from Creta, gaue lawes vnto the Latines  
wherby they myght gouerne them selues, & prescrip-  
ted them maners of lyuyng, teachyng them to yll and ma-  
nure the grounde, and sow coe, and to gather rype  
fruites in due season. And yf Saturne were profitable  
to those nations, and they not vnthankfull vnto hym  
in that they builded hym alters, celebrated vnto hym  
festiuall dayes, and accounted hym in the number of

Saturne  
gaue lawes  
to the Latis-  
nes.

Tillage of  
the grounde



## THE EPISTLE.

The golden  
woylde and  
reigne of  
Saturne.

The worthy  
factes of  
Charles the  
fyrst.

Sicilia.

Spayne re-  
newed.

The trium-  
phes & victo-  
ries of Char-  
les the fyrst.

the heavenly goddes, namyng him also the father of the  
Goddess. And yf (I say) he was to them so profitable, &  
that woylde iudged so happy and prosperous for hauyng  
so baliount a kyng, and so iust a lawe geuer, that it was  
therefoze by the mouthes of all men called the golden  
woylde and raigne of Saturne: Certes except I greatly  
deceauue my selfe, this our tyme is nothyng inferiour to  
that. For we knowe certapnly that your Maiestie hath  
ben moze profitable to Spaine, then euer was Saturne  
to the Latines: And also a moze excellenter lawe giuer  
in maner to all Europe, and further to the newe woylde  
lately discovered, then he that gaue lawes but only to a  
lyttle cozner of Italy. Wherby I consider that the fel-  
icitie of your Maiesties tyme hath ben no lyttle commen-  
dation to your doynge, in that you haue banyshed vice,  
honored vertue, punished offenders, and fauoured inno-  
centes: so that the quiet haue thereby lined moze peace-  
ably, the vnquiet restrayned, the good exalted, and the  
euyl chastysed. In so much that now, by reason of iust  
ministration of good order in your Maiesties dominions  
they that walke in the nyght go in safetie, whereas we  
knowe that in other prouinces, such as walke in the day  
go in daunger and peryll. And therfoze in the most hap-  
py tyme of your Maiestie, it appeareth that Spayne is  
renewed, not onely in the excellencie of mechanickall or  
handy craftes, but also in the knowledge of letters and  
discipline of warre: In so much, that she that sumtyme  
lacked her selfe, maye now abundantly minister to her  
neighbourours that haue neede. And wheras to your Im-  
pervall Maiestie, it should not suffice to ordeyne lawes,  
yf power and armes shoulde fayle to defende & punyssh,  
who comparable to your Maiestie enioyeth the one, and  
wanteth not the other, hauyng triumphed ouer kynges  
and kyngdomes, enlargyng also the name of Spayne in  
many vnknown and barbarous landes and nations:  
Greater duetie therfore owe your subiectes vnto you,  
then euer dyd the Egyptians to Isis, or the Cicilians to  
Ceres, or the Latines to Saturne: forasmuch as they haue  
receaued of your Maiestie moze common and profitable  
benefites

benefites. It is not long sence your Maiestie hath for-  
 bydden and abolsished the vse of Hules, and restored a-  
 gayne the exercise of armes so long out of vse, that the  
 one with the other hath ben no small profite and com-  
 moditie to your subiectes and dominions. For by taking  
 alwaie the vse of Hules, is so encreased the number of  
 hoxses and hoxsemen, that such as befoze neyther durst  
 nor could in maner lyght by vpo a hoxse, can now easely  
 & apely manege the. So that you seme to haue reuqued  
 the dayes of Bellerophon the sonne of kyng Glaucus, and  
 lykelypse the tyme of Saturne, when men had fyrste the  
 knowledge how to make hoxses to abyde the bydle, and  
 to bring them by to serue for diuers vses and necessities  
 of men. And ryght sure I am, that by reason of suche  
 laudable statutes and ordinaunces, in your dominions  
 shall sayle neyther hoxses nor hoxsemen, aswell for the  
 court as for the campe. Who knowe in maner howe to  
 girde a sword befoze y your maiestie permitted weapōs  
 and armure to be woꝛne euen in your courte, and that  
 elswhere all men might do the lyke: Befoze which time  
 dexteritie fayled where courage abounded.ouer and  
 befyde the profite & commoditie that hath ryfen hereof,  
 what honour you haue obteyned by the same is manifest  
 by Fraunces the French kyng, who by your Maiestie  
 being taken prisoner in the parke of Pavia, was brought  
 to Madrid in the yere. 1525. Where sepyng many young  
 men in maner without beardes, and yet laden with ar-  
 mure and weapons, sayde: Oh happye Spayne that  
 bringest forth and nourysheth men of warre. In your  
 most happy dayes also, the Christian faith is amplified:  
 and in maner whole Spayne flozrysheth dayly moze and  
 moze in sumptuous buildings, & is abundantly enriched  
 in treasure brought fro your Indies, farre surmounting  
 the riches of Salomon brought fro Ophir. Pea & to say  
 the trueth, cōsidering the Paxies of gold & siluer which  
 haue ben ordinarily brought fro thence to your maiestie,  
 this time may rather bee called the golde age, then that  
 of Saturne. Not omitting also that by your prosperous  
 attēptes, haue ben discovered so many landes & Ilandes  
 heretofore so vnknowē to y Cosmographers, Geographers,

Hules.

Hoxses and  
hoxsemen.

Bellerophō.

Mansyng  
of weapons  
and armure.Fraunces  
the French  
kyng taken  
prisoner.The Christy  
an faith in-  
larged.The sumptu-  
ous buildin-  
ges and cry-  
ches of  
Spayne.The Indies  
Paxies of  
golde and  
siluer.Newlandes  
and Ilandes  
discovered.



# THE EPISTLE.

& Historiographers that they neuer harde of their names. Which neuerthelesse are nowe so well knowen to your subiectes, that they haue troden them with theyr feete, and measured them by pases. Who befoze this tyme euer harde any mencion of the ryche and large prouince of Peru, or of the strayghtes of Magalians, or of the ryuer of Syluer, called Rio dela Plata. They in tyme past seemed to haue done no small thyng when they hadde knowledge of thefortunate Ilandes, the whiche sence they were conquered by your Maiesties graundefather, haue ben called the Ilandes of Canaria. And yf it is and hath ben muche to discouer and subdue this newe worlde: it is doubtlesse no lesse glozy to your Maiestie, not only to possesse and enioy it, but also that you dayly procure to sende thither Iudges to gouerne with lawes, and preachers to instruct in doctrine, to bryng those Indians to the knowledge and honouryng of the true God. And therfoze consideryng your Maiesties godly desyre and purpose as touchyng these Nauigations, and the daungers of such as go to discouer this newe worlde (although it be not newe to the Spanyardes to trauayle into farre countreys: forasmuch as in the dayes of Caius Cesar the sonne of Augustus, were founde broken pieces of Spanyshe shippes lost in the goulfe of Arabie, as also Celijs Antipater affirmeth, that certen shippes of Spayne were accustomed to sayle for marchaundyse to the east partes of Ethiopie) in consideration hereof haue I the more wyllingly publyshed these my trauayles for the furtheraunce of all suche as shall hereafter attempt the lyke Nauigations. And here do I not saye that Nauigation is not a thyng of antiquitie. For we reade that in olde tyme, the Argonauts sayled to Colchos, and Danaus brought the firste shyppe from Egypte to Grece. But I saye that I am the firste that haue brought the arte of Nauigation into a brieve commendousnesse, geuyng insaylable principles and euident demonstrations, describyng the practyse and speculation of the same, geuyng also true rules to Maryners, & shewyng wayes to Pilotes, by teachyng them the making and vse of instrumentes, to knowe and take the altitude

Peru.  
The strayghtes of Magalians.

Rio dela plata.

The fortunate Ilandes  
or Canaries

Religion in the Indies.

The Spanyardes haue euer trauayled into farre countreys.

The antiquitie of nauigation.

Argonauts.  
Colchos.

The arte of Nauigation  
Thynges pertainyng to Nauigation.

titude of the sunne, to knowe the tydes ozebbying and  
 flowyng of the sea, howe to order theyr cardes and co-  
 passes for Nauigations, geuing them instructions of the  
 course of the Sunne & motions of the Moone: teaching  
 them furthermoze the makynge of Dyalles both for the  
 day and for the nyght, so certen, that in all places they  
 shall thewe the true houres without defaute. And haue  
 likewise declared the secrete proprietye of the lode stone,  
 with the maner and causes of the Northeastinge & South-  
 westing (commonly called the variatio of the compasse)  
 with also instrumentes therunto belonging. And that,  
 that whiche I shall saye or do, be not accompted to bee  
 presumptuouslye done or spoken, I acknowledge that  
 whatsoeuer I haue well done or wrytten, it is from a-  
 boue by the helpe of the diuine grace, and by the fauoure  
 and prosperous fortune of your maiestie. And thus shall  
 they that now liue, and lyke wise they that shal succede  
 vs, se and perceaue, howe much moze the worlde oweth  
 and is beholding to your Maiestie, then were the auncient  
 Egyptians to their Isis. She gaue them letters to  
 reade, but your Maiestie hath geuen rules and orders to  
 sayle on the seas. The profite of Isis, was onely for one  
 prouince. But the commoditie that ensueth of your do-  
 ynges, is vniuersall for all prouinces and nations, and  
 for all seas, aswell to go to places discouered, as also to  
 discouer landes and regions yet vnknoen. If they of  
 auncient tyme had reached that we haue obteyned, the  
 Indies had not now bene to discover: neyther should it  
 be esteemed a miracle vnto vs as at the tyme when Car-  
 thage flopyshed, that one Agnus went forth from the  
 baye of Cadiz, and sayled to thende of Arabie. Neyther  
 woulde Cornelius Nepos haue wrytten it for so famous a  
 thyng, that a certayne man flyng from kynge Latinus,  
 came from the goulfe of Arabie: Whereby it is manifest  
 that aswell Nauigation as other artes, doth from day  
 to day increase, and by lytle and lytle is come to perfec-  
 tion. For in those dayes they had neyther compasse nor  
 carde of saylyng whereby to gouerne themselves. They  
 lacked the consideration of the starres, vntill the Phenici-  
 ans

The lode  
 stone, callid  
 in  
 Englysh the  
 Adamant, is  
 in Latin cal-  
 led  
 Magnes.

Charles the  
 first greates  
 then the He-  
 roes of olde  
 tyme.

Vniuersall  
 benefites

Comparatō  
 with the an-  
 tiques

Plinie.

Nauigatio  
 ons of olde  
 tyme

The perfec-  
 tions of  
 artes at this  
 day.



# THE EPISTLE.

The rudenes of the antiques.

Anguriū.

The North Starre.

The blages of Salomō to Tharſis and Ophir.

The fyrst inuentours of Nauigation

Commodities and difficulties of Nauigation

cians founde the knowledge thereof, and were the fyrste that vnderſtode (that to such as shoulde trauaile by sea) it shoulde be necessary to lyfte vp theyr eyes to heauen, and consider the motions therof. They that sayled to the Ilande of Taprobana (which in olde time was called Antitono) carped for theyr vyages luyng byrdes. And when they thought good, let certeyne of them flee: and by the flyght of their wynges, directed the helme and sayles of theyr shippes. They sayled onely thre monethes in the yere. To them therfore it was necessary to obserue and tarye the tyme vntyll they founde it to serue with a forewynde. They knew not howe to helpe them selues with the bowe line or syde wynde: neither sawe they the North starre, or sought it, or had any knowledge thereof. And I beleue verely that this was the cause of so long a vyage whiche the shippes of Salomon made, saylyng to Tharſis and Ophir, wherin they spent thre yeres: although in deede that was no short vyage whiche they made, compassyng about India and many other prouinces. And wheras before I sayde that Nauigation by lyttle and lyttle came to perfection, I fynde by auncient histories, that Tippo fyrst founde the gouernall or rudder, Dedalus the maske and shroudes, and Icarus the sayles. The Thirreni founde the vse of the anker of one graspe or flooke, and Palaminus brought it to perfection, addyng the other. And thus may it manifestly appeare that in these prosperous and fortunat dayes of your maiestie, it hath pleased God to byrnyng the knowledge of Nauigation to perfection, with this my bryefe discourse as touchyng the same, as well profitable and necessary for them that trauaile by lande as by sea. What can be a better or more charitable dede, then to byrnyng them into the waye that wander: What can be more difficulte then to guyde a shippe engoulfed, where only water and heauen may be seene. One of the foure most difficult thynges wherof Salomon maketh mention in his Prouerbes, is the vyage of a shippe by the sea. The which Galfrede expoundyng, saith that in humayne thynges, none is more fearefull or more dangerous, then

then to auenture lyfe in a weake & thinne piece of wood,  
or for a man to commit him selfe to the rage of furious  
wyndes amonge the tempestes of the sea, and there to  
hazarde that he loueth so well. Oh howe muche more  
should the same seeme difficult to Salomon, yf at these  
dayes he should see that fewe or none of the Pilotes can  
scarsely reade, and are scarsely of capacitie to learne.

The igno-  
raunce of  
Pilots.

And wheras in the first Chapter of this booke, I haue  
made mention, that the gouernall or sterage ought to be  
committed to expert men and of good vnderstanding, he  
should see that howe a dayes the ignorant presume to  
gouerne other, which were neuer able to rule or gouern  
them selues. I moste humblye desyre your maiestie to  
receaue in good parte this my poore seruice. Which al-  
though it be lyttle, yet being dedicate vnto the greatnes  
of your regall person, it shalbe much more then greate.  
The profite and commoditie thereof is notozious: and  
the benefite that therby may be receaued, is vniuersall.  
If therfore when your maiestie shall fynde your selfe re-  
leased from greater affayres, it may please you to feede  
your eyes with these my traunples, you shall fynde  
therin many newe, delectable, & wytty thynges:

The gouer-  
nall.

With also many profitable and certen rules  
both to reade and vnderstande. To con-  
clude, I estones make humble  
petition vnto your Impe-  
riall Maiestie, not so  
much to con-  
sider what I  
wyte,

as to respecte thintent of my wytyng: and  
not the gyfte, but thaffection and  
good wyll that remayneth  
in me to serue your  
Maiestie.

(.)

Q



**The first parte of thys Woozke**  
**which entreateth of the composition**  
**of the worlde: And of the vniuersall**  
**principles for the arte of**  
**Navigation.**

**The first Chapiture of the generall distinction**  
**of creatures.**

There differ-  
ences of  
creatures

Corporall  
creatures,

Man is cal-  
led all crea-  
tures & the  
lesse worlde

Man compa-  
red to the  
worlde

All that mo-  
ued, is mo-  
ued by an o-  
ther immo-  
uable

The intell-  
tue soule



**The infinite god, the begin-**  
**ning and cause of the hole vniuersall,**  
**created thre orders of creatures, diffe-**  
**ringe in kynde: That is to say, corpo-**  
**rall, as the Elementes: Spiritual as**  
**Angelles: And compounded of these**  
**two, as man. The corporal nature is**  
**deuided into bright and shining bodyes, as the starres,**  
**or into darke and thicke bodies, as earth and metalles:**  
**Cyther into Diaphane or transparent bodyes, as ayre**  
**and water. Of these creatures (as sayth S. Gregory)**  
**some haue onely beyng, as stones, some lyue as trees,**  
**and other haue sence, as beastes, other vnderstanding,**  
**as man: who in holy scripture is called al creatures, ac-**  
**cordinge to the sayinge of Christ to his disciples, where**  
**he sayth: Go and preach the gospel to al creatures. And**  
**therefore not without good cause was man called of the**  
**greke philosophers Microcosmos (that is) the lesse worlde.**  
**In the which we contemplate thynges of no lesse admi-**  
**ration, then in the greate worlde. The similitude be-**  
**twene them both, is that euen as the great worlde, and**  
**the hole Globe or sphere thereof, is moued by the volun-**  
**tarie motion of an intellectuall substaunce, or an Angell:**  
**euen so is this. For (as Aristotle writteth) what so euer**  
**is moued, is moued by vertue of another: as man is mo-**  
**ued by the internall or inwarde forme that is within**  
**him: (That is to say) by the intellectuall soule that is pro-**  
**per vnto hym. In lyke maner in the great worlde are**  
**founde dyuers mouable thynges: All whiche are reduced**  
**to one immouable mouer. So in man are founde many**  
**thynges**

thynges moued by diuers motions, which are all referred to his intellectuall soule. The great worlde containeth the creatures within it selfe: And consequently is all really, as hauyng nothinge without it. Euen so man by knowledge is all, and knoweth all thynges, and no thyng naturally is hyd from hym or vnknown to hym. Agayne, in this lesse humayne worlde are two motions, intellectuall, and sensuall. Then consequently the great worlde hath two local motions. The one wherewith the fyrst mouable is moued, & draweth with it all the other spheres from the East to the West, and is called Rati-  
 onall mouing. The seconde is the mouyng of the other spheres frō the West into the East: And is called Irra-  
 tional mouing. But now leauinge to speake of the lesse worlde, we will procede to speake further of the greater.

Man knoweth  
 every part of  
 all thynges

Two motions  
 in man

Primum  
 mobile.

Rationall  
 motion.

Irrationall  
 motion.

## The seconde Chapter of the defini- tion of the worlde.

**T**he worlde (as sayth Isodorus) is heauen and earth, and the other woordes of God that are contained therein. It is compounded of thynges visible, and yet vnsearchable. Moyses and S. John the Euangelist, witnesse that it was made by God. The Philosophers called it Mundus à mouendo, because it is in continuall mouyng and neuer in rest. The Grekes called it Cosmos, which signifieth faire or beautiful, and so named it because of the meruailous ornament therof, and diuersitie of Elementes, with the resplendence or shining of the sonne, moone, and starres. And doubtlesse nothinge maye bee sene with the corporall eyes of man moze bewtiful then it is. In so muche that the diuine Philosopher Plato, affirmed that eyes were geuen to men to beholde the bewtie therof, and to take pleasure in the contemplation of the heauenly bodies and roundnesse of the worlde, which also for the roundnesse therof, is called sphericall, because that Sphera in the Greeke tongue, signifieth a rounde body.

what is the  
 worlde.

Or Mundus à  
 Mouendo.

that is cleas-  
 nes of dayes.

Eyes were  
 geuen to me  
 to beholde  
 the faynes  
 and beautie  
 of the worlde

The round-  
 nes of the  
 worlde.

The



## The third Chapter of the definition of the Sphere.

Definition  
of the sphere



Heodosius saith that the sphere is a whole and corporal figure vnder one superficial: in the middelt wherof is a point or picke, from the which all ryght lines drawen directly to the circumference are equall.

The center  
of the sphere

This poynnt or picke is called the center of the Sphere. Accordyng to Euclide, it is the passage of the circumference of halfe a circle, whiche beyng fixed, the Diameter is turned rounde about, vntyll it retorne to his owne proper place. By the center of the Sphere

The axis &  
poles of the  
woylde.

passeth a ryght line, and thetremities or endes therof, touche in the circumference. And this line (imagined) is called the Axis or Criltre of the Sphere, and the endes therof are called the poles. Upō this Axis, is the sphere of the woylde moued.

## The.iiii. Chapiter of the di- uision of the woylde.

Quinta El-  
sentia.  
Aristotle cal-  
leth it the .v.  
element.



It is to be presupposed that there is difference betwene element and elementate, and the fyfth being, called Quinta Elsentia;

The .v. el-  
sence is in-  
corruptible.

The quint essence or fyfte substance, is a body of it selfe, differing from all elementes and thynges elemental, aswell in matter as in forme, and no lesse in nature and vertue. And hauyng in it selfe no contrarietie, is certainly without corruption. And hereof commeth it that the Philoso-

What is e-  
lement.

phers called the heauens and heavenly bodyes, the fyfte substance or fyft essence, by reason of the incorruptibi-  
lity therof. Element is that wherof any thyng is compounded. It is the fyrste of compositions: & of it selfe is not compounded. Wherby it foloweth, that neither the

The inferi-  
our elemen-  
tes are not  
pure nor sim-  
ple.

earth, the ayre, the water, nor the fyre, that are nere vnto vs or about vs, are pure or simple elementes. For these elementes do sometymes myngle them selues one with

with another: and especially where they are nere together and touch one another. Of these elementes, every part is named by the name of the whole. As every part of fyre, is called fyre, and every parte of earth is called earth, and so of the other. They are called simple bodies in respect of other compounde and mixt bodies. They are diuisible into partes of diuers fourmes: and of the commixtion of them, are made and engendred dyuers thinges of sundry kindes. These foure (that is to meane earth, ayre, water, and fyre) although they are named simple but in respect as aforesayde: yet are they the Elementes (that is to say) begynnynge and principles of al other compoundes and mixtes. A pure element can not be sene, forasmuch as that that is pure, lacketh colour: and that hath no colour is not visible. The elementes (as saith Iodorus) were deuyded by the hande of God. The Emperiall heauen was replenished with Angels, the aire with byrdes, the sea with fyshes, and the lande with men and other beastes. Elementate, is every body compounded of the foure elementes. Not that they are elementes formally, but virtually in mixt bodies. This knowen, we wyll shewe howe the worlde is deuided into two regions: Celestiall, and Elementall. The region Elementall, which is continually subiecte to alteracions, is deuided into foure elementes: Which are, earth, water, ayre, and fire. These elementes, the Grekes call Ylogia, for the communion and con corde that they haue betwene them selues. The heauenly or etherial region (called Quinta Essentia) compasseth and conteyneth the elementall worlde within it.

The elementes are diuisible into partes.

The commixtion of elementes.

Pure & simple elementes can not be sene.

The diuisiō of elementes

What is elementate.

Diuisiō of the worlde into celestiaill and elementall.

Quinta Essentia.

## The .v. Chapter of the number, order, and propertie of the elementes and heauens.



The order of  
elementes

earth.

water.

Ayre.

fyre.

The fourme  
of the water



The earth (after the Philosopher) is a  
pylike oz poynt in the myddest, called  
the center, to the which they assigne  
the lowest place. Next vnto the earth  
and about it, the water occupieth the  
seconde place, and the Ayre the third.  
The fyre is hygher then any of the o-  
ther elementes. And it is to vnder-

stand that the water hath two superficialis. One, which  
is called concaue oz hollow. The other, conuer oz em-  
bowyng. You maye compare the inward parte of the  
concaue to a dyshe oz a bolle, whose outwarde parte is  
called conuer. As touchyng the concaue, the water com-  
passeth about the earth, leauyng discovered that parte  
that serueth for the respiration and lyfe of men, and o-  
ther beastes. As concernyng which, some thynke that  
the Ocean sea is hygher then the earth: and aske the  
question why the sea couereth not the whole earth, and  
why the earth is not sonke in the water. To this it may  
be a sufficient aunswere, that it hath so pleased the wyl  
of God accordyng to the saying of the Prophete Dauid:  
Terminum posuisti quem non transgredietur: Neque con-  
uertetur operire terram. That is: Thou hast appoynted  
limittes which it shal not passe, neyther shal it returne  
to couer the earth. Besyde the wyl of God whiche is  
the chiefe and sufficient cause therof, we say that nature  
sayleth not in her necessities. For she sometyme ad-  
mitteth a little inconuenience, to auoide a greater euyl:  
as when heauy thinges which naturally shoulde descend,  
do not onely not descende, but ryse by: And as also som-  
tymes it chaunceth that fyre descendeth and water arri-  
seth to fyll the voyde oz emptye place, least any where  
shoulde be found voyde oz emptye, which nature so great-  
ly abhorreth. To this purpose, nature foreseynge the  
kyndes of many thynges that coulde not els where lyue  
then on the earth, neither be conserued within the wa-  
ter (as men and other earthly beastes) determined be-  
fore to make the earth not perfectly rounde contrary to  
the nature therof: wherof it foloweth, that it is not al-  
together

The Ocean  
sea.

psal. 107.  
Job xxxviii  
The will of  
god is the  
cause of  
causes

Nature ab-  
horreth emp-  
tiness

The earth  
is not perfect-  
ly rounde

together couered of the water. And (as sayth Origen) the earth remayneth discouered of water, that it might bying forth frutes, trees, and plantcs. As touching the conuer aforesayde, the water and earth discouered, are conteyned vnder the concavitie of the ayre, which is deu-  
 uided into thzee regions, as the lowest, highest, & middlemost. The lowest is hot by reason of the reflection oꝝ reboūdyng of the beames of the sunne striken backe by the earth. The highest also is hot by participation of the fyre and nearenesse therunto. The myddle region is colde, as is manifest by the snowe and hayle engendꝛed in the same. The ayre neare vnto the region of the fyre whiche is pure heate, doth neyther burne noꝝ lighten, because it hath no combustible matter, & so hath it power and not act. It is neare vnto and reacheth the circle of the moone whiche compasseth it about. The heauen oꝝ circle of the moone is next vnto the heauen of Mercurie: And Mercurie vnto Venus: Venus vnto the Sunne, the Sunne to Mars: Mars to Jupiter: Jupiter to Saturne which is next and reacheth vnto the heauen of the starres, called the firmament, because that in it are all the starres (except the planets) firme and fixe as a knot in a table. The knowledge of the planetes was had by seuen sundꝝ motions they haue amonge themselues, and by their course not vniforme to that of the starres of the eyght heauen, because that sumtymes the planetes appeare vnto vs ioyned together, and sumtymes deuyded. The Crystalline heauen, compasseth aboute oꝝ conteyneth within it, the heauen of starres. This Crystalline heauen, is transparent & perspicuous as cleare water oꝝ glasse that maye bee sene through by reason of the cleannesse and pure substaunce therof. It is by another name, called the heauen of water, whereof holpe scripture speaketh, saying: *Aquæ quæ supra cælos sunt*, laudent nomen Domini. What is to say: Let the waters that are aboue the heauens, prayse the name of the Lorde. It was created for the conseruation of corporall thynges, and to temper the heate engendꝛed of the mouing of the first moueable, which beinge so great of body that it not  
 onely

Deuision of  
the ayre into  
three regi-  
ons

The highest  
ayre is incor-  
bustible

The order  
of the hea-  
uens

The firmam-  
ent

The pla-  
nets

The Cryst-  
alline hea-  
uen

The heauen  
of water

psalm. 148  
Daniel. 3.

The moue-  
ing of the  
first moue-  
able



The cold-  
nes of the  
Cristalline  
heauen.

The swifte  
course of Sa-  
turne.

The heauen  
of the fyfth  
mouable.

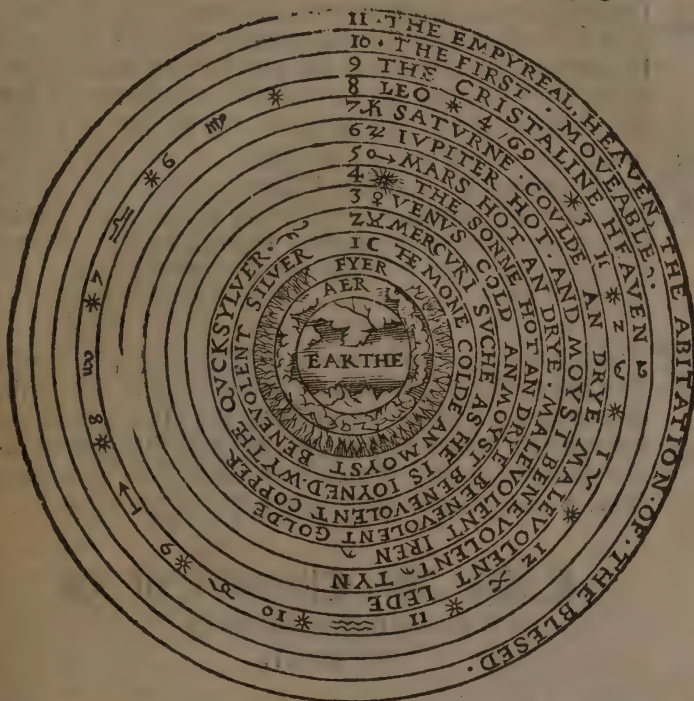
The heauen  
called Empe-  
rium, is not  
moued, & is  
the habitaci-  
on of angels

The huma-  
nitie of  
Christ in the  
Empyreall  
heauen.  
The orders  
of Angels.

The imperial  
heauen pre-  
serueth all  
the other  
heauens.

only compasseth all the elementes, but also all the infe-  
riour heauens is moued so swiftly, that it dayly perfect-  
ly moueth all the aforesayde spheres. And least by rea-  
son of the great heate therof caused by his swift motion,  
it shoulde consume inferiour thynges: God ordeyned this  
Cristalline heauen that the coldenes therof myght tem-  
per thetreme heate of the other. And this appeareth by  
Saturne, which beyng the hyghest of all the planettes,  
shoulde be feruent hotte more then any of the other, be-  
cause it hath a swifter course and moueth faster then a-  
ny of them, and maketh dayly a greater circuite. But  
fozasmuch as it is nearer vnto the sayde Cristalline hea-  
uen, the heate therof is tempered by the naturall colde-  
nes of this watershe heauen, wherby (as I haue sayd)  
the feruour therof is qualified and restrayned from the  
hurte it myght otherwyse doo. This Cristalline heaue  
reacheth to the fyfth moueable heauen called Primum  
mobile. And this reacheth to the Imperial heaue which  
is the twelfth, called Empyreum, by reason of his cleare-  
nes and resplendence. This is not moued, and is mosse  
perfecte. The Philosophers had no knowledge hereof.  
But we beleue by holy Scripture that suche a heauen  
there is, and the same to be the habitacion of Angelles  
and spirituall creatures. It is also called Cælum cælorū.  
That is: The heauen of heauens, because it conteyneth  
and includeth within it all the other heauens. It is of  
greater clearenesse then all the other heauens, and was  
created immediatly with the Angelles. In this also res-  
mayneth the humanitie of Jesu Christe our God, and in  
dignitie aboue it. It conteyneth thre holye orders of  
ppincipalities called Hierarchias. Wherof, the fyfth is  
called supercelestiall, and hath in it also thre orders: as  
Seraphins, Cherubins, & Thrones. The second is cal-  
led Celestiall, and conteyneth Dominations, Princi-  
pates, & Potestates. The thyrde called Subcelestiall,  
conteyneth Virtutes, Archangels, and Angels. And to  
conclude, it hath aboundaunce of all goodnes and per-  
fecte felicitie, with ppiuation of wante of all euill.  
This heauen also geneth influence of constancie, sted-  
fastnes,

fastnes, and durabilitie to thynges, agaynst the flurbilitie and inconstancie of the other heauens : the order wherof doth appeare in the demonstration folowynge.



## The. vi. Chapter of the immutabilitie or immobilitie of the earth.



**T**he Pithagorians & other ancient naturall Philosophers (as saith Aristotle) were of opinion that the earth dyd moue. Yet not by a ryght forth motion, but circularly about, in the myddest of one place. The whiche errour, both Aristotle hym selfe and the

Opinion  
that the  
earth mo-  
ueth.  
Molus in  
loco,



The earth  
is immou-  
ble

All heauy  
thynges in-  
cline to the  
center of the  
earth

The earth is  
founded vpon  
his owne  
center

Psal. 103.

the Astronomers do confute and reprove by euident cau-  
ses and manifest demonstrations: For circular motion  
is proper to the heauens. And as the earth dyffereth fro  
them in nature, so lykelysse in mouyng. And although  
it so be that the earth may naturally moue by certen of  
his partes, yet to moue in the whole, and without the  
circuite of his sphere, it is impossible, being founded and  
establyshed vpon his owne center, the whiche of it selfe  
is naturally immouable: forasmuch as in it the reason  
of all beautinesse consisteth. Wheras otherwysse, euery  
part that is moued shoulde ascende, contrary to the na-  
ture of all heauy thynges. But there is founde nothing  
heauy that doth not naturally incline directly to the cen-  
ter of the earth, and wolde actually descende thither yf  
it had no impediment of some other thyng to resiste it.  
And when it toucheth there or is come thither, wolde  
styll rest and remayne there. And hereby it foloweth,  
that the earth beyng founded vpon his owne center, is  
not moued. The which thyng, the Prophet Dauid al-  
so affirmeth, saying: Fundasti terrā super stabilitatē suam.  
(that is.) Thou foundedst the earth vpon his stabilitie.

## The. vii. Chapter, of the roundenesse of the earth and water.

The round-  
nes of the  
earth

The rysyng  
of the sunne

The Eclipse  
of the moone

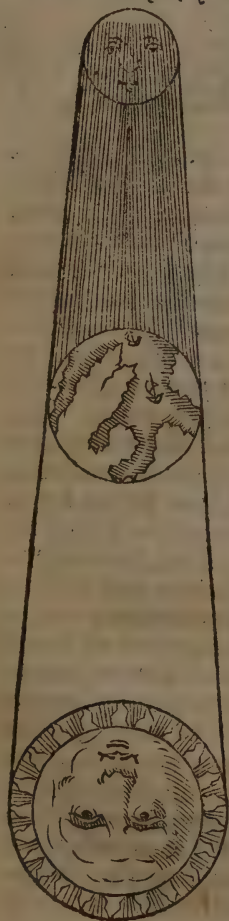


That the earth is rounde, it appeareth  
by manifest euidence. For yf it were  
playne or flatte, the dawning of the  
day or day spyng, shoulde equally  
at one tyme appeare to them in the  
West, as to them in the East. But  
we see the contrary, that it ap-  
peareth first to them that dwell in the East,  
and afterwarde to them in the West. This is proued by  
the Eclipse of the Moone, which begynnyng at one in-  
stant: they of Jerusalem see it begyn at foure a clocke  
of the nyght, and we of Andalusia in Spayne, at one a  
clocke

clocke of the nyght. It foloweth hereby that to them it  
nyghteneth thre houres soner then vnto vs in Spaine.  
And this is caused by the roundnesse of the earth. It is  
also aswel knowen to be rounde from the pole Artyke to  
the pole Antartike: for by the roundnesse therof, is cau-  
sed the equalitie and inequalitye of the dayes & nyghtes.  
The same is lykelysse knowen by the raysynge of the  
pole aboute our Horizon. And that the superficiall parte

The equalitie  
of dayes  
& nyghtes.

The earth &  
the water are  
one rounde  
globe.

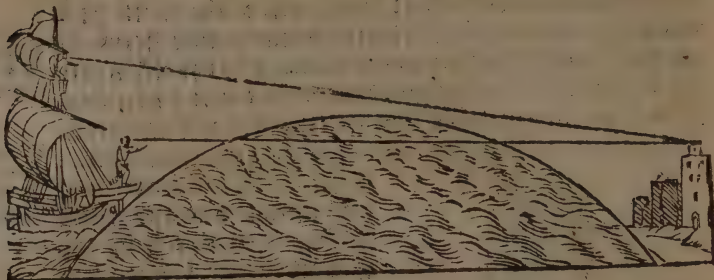


of the earth and water is al-  
one rounde and sphericall  
globe, is manyfest by the  
shadow therof, being a cer-  
tayne darke body reflected  
fro the earth in the Eclipse  
of the Moone. For by this,  
as by playne demonstrati-  
on, may we know that the  
earth is rounde, as maye  
more manifestly appeare bi  
this figure. It is also pro-  
ued y the water is a rounde  
bodye, as is sene by experi-  
ence. For yf you erecte a  
marke vpon the sea banke  
of a porte, and a shyppe de-  
parte from that porte a cer-  
tayne space: then standing  
in the poupe or sterne of y  
shyppe, you shall not see the  
marke aforesayde. But yf  
you stande in the toppe of  
the shyppe, then maye you  
see it. Whereas notwith-  
standing (yf that portion of  
the bendynge arke of the  
earth dyd not hynder the  
syght) you should see it bet-  
ter beyng in the poupe: for  
asmuche as it is nearer to  
the mark then is the toppe

The water  
is a rounde  
bodye.



of the hyppoc, as by this demonstratton appeareth.



Howe the  
earth is  
rounde.

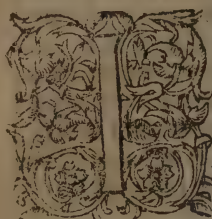
But here some may moue a doubte: saying that on the earth we see many mountaynes, and consequently many greate balleyes and playnes, with many diuersities of sundry other depe & vnequall places, by reason wherof the earth can not truely be called rounde. To this I say, that in two maners the earth is called and vnderstood to be rounde. As after one maner speaking precisely, it is called rounde as a circle or a sphere whiche we call rounde, because that all ryght lines drawen from the center therof to the circumference, are equall. The other roundnesse is considered without this precisenes: And is such, as not by all his partes is equally distaunte from his myddest or centre, but hath some partes hygher and some lower: yet not in such quantitie as may destroy the roundnesse of the whole. As if in a bowle there were certayne clyftes or holes, it shoulde not thereby leaue to be rounde, although not perfectly or precisely round. And for this cause saith Auerrois: that although both the heauenly bodyes & the elementes are of rounde forme, yet differ they in this, that the heauily spheres haue perfecte roundenesse, and the elementes not: As the earth by reason of his mountaynes and vales, the sea by his encreasynge and decreasynge, the Ayre also for his nearenesse to the fyre, and by his contrarietie, doth sometyme do and sometyme suffer (What is to saye) is sometyme actiue and sometime passiue. So that folowynge the one it fleeth the other, by reason wherof, it also lacketh

The ayre is  
actiue & passiue,  
and not  
perfectly  
rounde.

lacketh perfecte roundnesse. But the fyre, forasmuch as <sup>The fyre is</sup> it is neare to the concaue of the circle of the moone, whi- <sup>rounde.</sup> che is sphericall, maye therfore be called sphericall oꝝ rounde.

## The. viii. Chapiter, of the

motion of the heauens and  
elementes.



It is not to be forgotten that all the elementes are wholly moueable by local motion, ercepte the earth. The water is moued by the motion of the Moone, oꝝ tossed by the wyndes. The fyre (as saith Aristotle) is moued circularly by the motion of the daye, and is drawen of the circles that embrace

*Moue the  
fyre is mo-  
ued.*

it oꝝ compasse it about: As is manifest by the Cometes oꝝ blasynge starres, and other fierie exhalations conteyned and engendꝛed in it: Which being carped with this motion, conclude that the fyre moueth in lyke maner.

*Moue the  
ayre is mo-  
ued.*

And with this motion is the superioꝝ parte of the Ayre violently carped about, as the other impressions therein do shewe. The inferioꝝ parte is moued by dyuers motions: (That is to meane) laterally, as by experience we see when the wyndes blowe.

*The Moone*

The Moone with her heauen oꝝ sphere, by her proper motiō geneth her turne from the Weste to the East in: xxvii. dayes and seven houres, with. xlv. minutes. Venus, Mercury, and the Sunne, in a yeaꝛe: whiche is the space of thꝛee. C. lrv. dayes, with. v. houres and. xlii. minutes. Mars in two yeaꝛes. Jupiter in. vii. yeaꝛes. Saturne in. xxi. yeaꝛes.

*Venus,  
Mercury,  
The Sunne  
Mars.*

The. viii. heauen which is the firmament oꝝ starry heauen, by his owne proper motion is moued by the. ix. heauen vpon the begynnyng of Aries and Libra, and vpon these two poyntes accompliseth his reuolution in seven thousande yeaꝛes.

*The starry  
heauen oꝝ  
firmament.*



The Crystal  
line heauen.

first moue-  
able.

Howe the  
first moue-  
able draweth  
the other hea-  
uens.

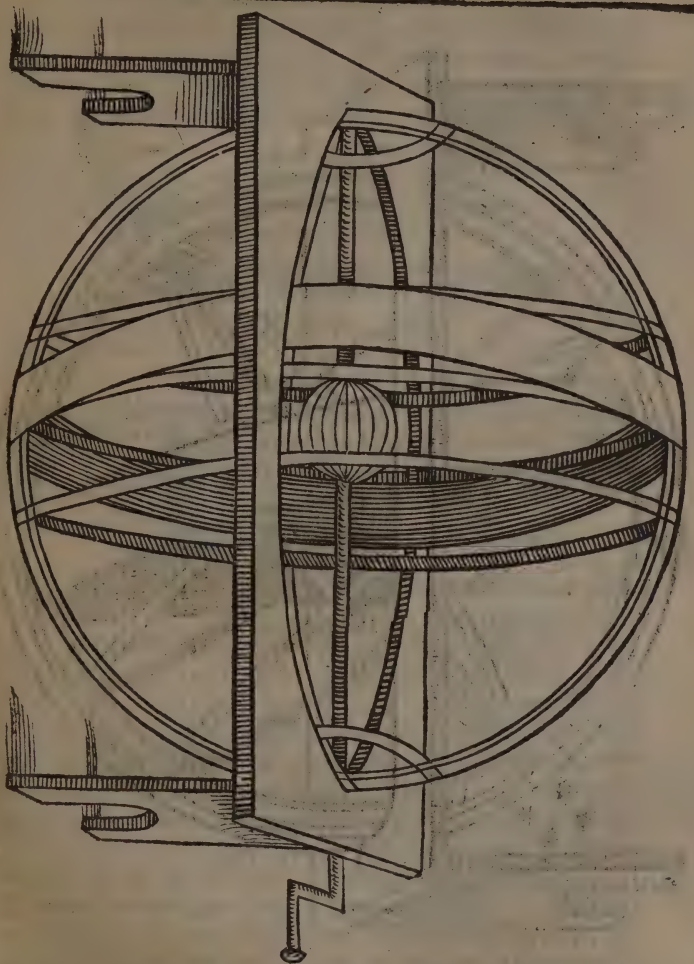
This motion is called *Motus crepidationis*, (that is to say) the tremblyng motion, or motion of accesse and recesse. The ninth heauen endeth his motion from the West to the East in. xlii. thousande yeares. And by this motion moueth the eyght heauen. The. x. heauen called *Primum mobile* is moued from the East to the West: And in. xliiii. houres (which is a naturall daye) perfourmeth one reuolution, & with the myghtye force and swyftnes of his motion, caryeth with hym all the other inferiour heauens, and maketh them to geue the same turne in. xliiii. houres, wheras neuerthelesse they cease not in the meane tyme to kepe the course of theyr owne proper motion: as (for example) if an Ant or Dismer shoulde go about the wheele of a myll, contrary to the mouyng of the wheele: befoze the Ant in goyng styl forwarde shoulde come agayne to the poynt from whence he first departed (which is once about or one turne) the wheele shoulde in that space make many turnes.

## The. ix. Chapter, of the diuision of the Sphere into sozmall partes.

The right &  
crooked or  
oblique  
sphere.



The Sphere of the woꝛlde is diuided in two maners. (That is to saye:) by substance and by accident. By substance into. x. Spheres, as we haue sayde. By accident, into a ryght Sphere, & oblique or crooked sphere. They haue the ryght sphere that dwell vnder the Equinoctiall line: and is called ryght, because to the poles are equally in the Horizon, as appeareth by this figure folowynge.

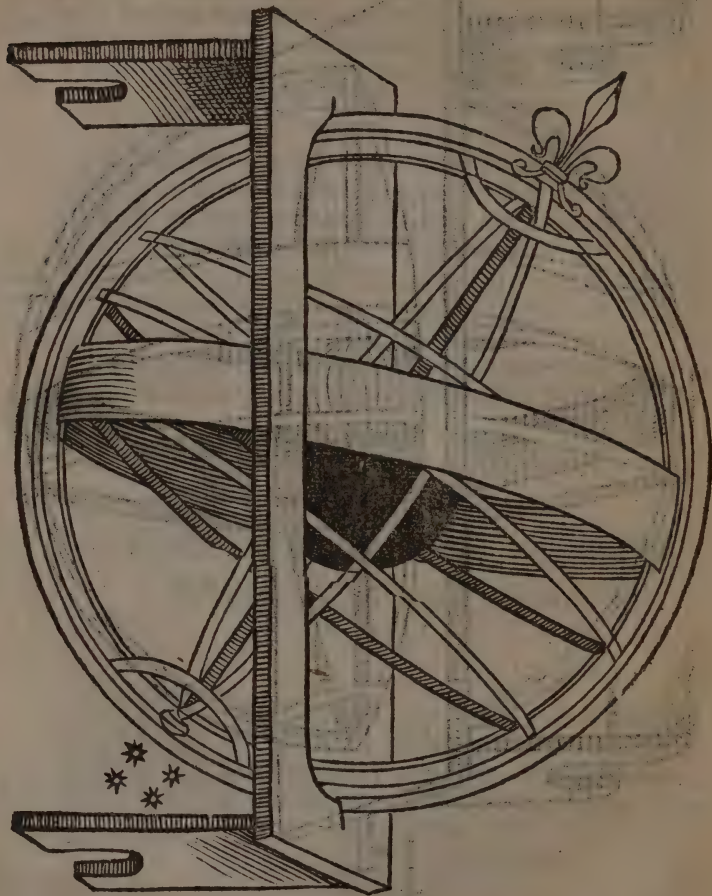


They haue the oblique Sphere that diuel eyther on this  
 syde or the other syde of the Equinoctiall : vnto whom  
 B iii is

The oblique  
 or crooked  
 Sphere,



is ever one of the poles above the Horiz<sup>l</sup>, and the other  
under it, as appeareth in this figure.



The. 2. Cys-  
cles of the  
Sphere.

The sphere is compounded of. x. circles imagined. And  
(as saith Iohn de sacrobosco in his booke of the sphere) five  
of

of them are greater, and foure lesse. The greater circle, is that which deuiddeth the sphere into two equall partes, and hath his center with the center of it. These are the Equinoctiall, the Zodiac, the two Coluri, the Horizon, and the Meridian. The lesse circle, is that that deuiddeth the sphere into two vnequall partes. These are the two Tropicke, and two Polar circles.

## The .x. Chapiter, of the

### Equinoctiall Circle.



The Equinoctiall is a circle that deuiddeth the sphere into two equal partes and is by euery part equally distaunte from both the Poles. It is the greatest circle among the other, and is describ'd in the sphere by the motion of the Primum mobile or first moueable.

The Equinoctiall.

This circle for his equalitie and regularitie, is more noble then the Zodiac whiche we haue describ'd in the eyght sphere, and also then anye of the other. It is imagined to gyrd the worlde round about by East and West. It is called Equinoctiall, because this worlde Equinoctium signifieth equalitie of nyghtes and dayes: whereof the cause is, that the Sunne coming to this circle, the arke of the day is equall with the arke of the nyght: and then is the Equinoctiall. It is also called the Zone or gyrdle of the first moueable. For euene as a gyrdle doth gyrd a man by the myddeste, so doth this circle gyrd the myddest of both the Poles, by on the which the first moueable is moued. One of these imagined on our parte of the Sphere, is called polus Arcticus, because it is neare vnto certayne starres which the Astronomers call Arcturus, which is the great beare.

The equalitie of the day & nyght

The first moueable.

The pole Arctike.



Septentris:  
on.

The hozne  
North Starre

Pole Antart:  
tyke.

The crosse  
made vnto  
the pole  
Antarttyke.

It is called Septentrionall or Septentris, because that round about it are moued the seuen starres, which make the lesse Beare commonly called Bozina, (that is) the hozne. The principall and chiefe of these, is the North Starre, which is neuer sene to vs although the nyght be neuer so cleare: And (as the Poet Homer saith) doth mone lyttle or nothyng, because of his lyttle distaunce from the Pole. The other Pole is imagined on the other contrary part, and is called Polus Antarticus of the woerde Ante, which signifieth agaynste, contrary, or opposite, because it is on the contrary parte from the pole Artyke. It is also called the South pole, because that from that part of heauen commeth the wynde commonly called the South, and is lykewyse called Meridional because it is ryght South from vs. This is neuer sene to vs. They that dwell vnder the Equinoctiall, or come nearer vnto this pole Antarttyke, haue for a signe or marke to knowe it foure starres in foume of a crosse. And when the greatest of these is lowest in the foote of the crosse, they say it is. xxx. degrees aboue the pole. And as we can not see theyr Pole from hence, so can they not see our Pole from thence.

## The. xvi. Chapiter of the Zodiacke Circle.

Zodiack



The Zodiack is defined to decline or bende it selfe from the Equinoctiall. It is a great circle which deuideth the Sphere in two equall partes, cutting the Equinoctial by oblique or crooked angles: So that beyng thus cutte or deuyded by it into equall partes, one parte thereof declyneth toward the South, and the other toward the North. This circle is called the Zodiack of this woerde Zon, whiche in the Greke tongue signifieth lyfe, because that accordeinge to the mouynge of the planettes vnder it, is the lyfe of inferiour

inferiour creatures : Oʒ is so named of Zodion whiche signifieth a lpyng beaste. And is therfoze deuyded into xii. equall partes, wherof euery part is called a signe, and euery signe hath an especiall name of some beast, in respecte of some ppropertie agreable to the same : oʒ soʒ the oʒder and disposition of the syrte starres in those partes somewhat repʒesentyng the similitudes of suche beastes, it is called Zodiack. The Latins called this circle Signifer (that is) the signe bearer, because it caryeth these signes in it, oʒ is deuyded into them. Aristotle called it an oblique oʒ crooked circle, affirmyng that accordyng to the comming nere oʒ departing of the Sunne from the oblique circle, are caused generations and corruptions in inferiour thynges. The. xii. partes into the whiche this circle is deuyded, are called the. xii. signes. That parte which declyneth to the North, conteyneth. vi. signes Septentrionall, and the other that declineth to the South conteyneth other syre called Meridionall. Furthermoze, it is to consyder that the Zodiack may be deuyded in two maners. One by longitude oʒ length into the. xii. signes aforesayde, and euery signe is deuyded into. xxx. degrees, which make. CCC. lx. degrees. Lyke wyse euery degree is deuyded into lx. minutes, and euery minute into. lx. secundes, and euery secunde into. lx. terces, and so to tenne. The other deuision of the Zodiack is by latytude oʒ breadth. By latitude it is deuyded into. xii. degrees, and in it we imagine a line that deuydeth his latitude by the myddest haupng. vi. degrees on euery parte oʒ syde. And this line which diuideth into two equall partes the breadth oʒ latitude of the Zodiack, is called the Ecliptyke line, because that when the Sunne and Moone are directly vnder this line, eyther ioyned together by coniunctiō, oʒ deuyded by opposition, then is the Eclipse of the Sunne oʒ of the Moone. Under this Zodiack the seven planets are moued. The Sunne also passeth by the myddeste of the sayde Zodiack by the ecliptyke line, not inclynynge moze to the one part of it, then to the other. But the other planettes do sometyme go towarde the North, and other

The twelue  
signes of  
the zodiack.

Howe the  
Sunne is  
cause of ge-  
neration &  
corruption.

Deuision of  
the. xii. sig-  
nes.

Deuision of  
signes into  
degrees.

Deuision of  
the zodiack  
by latytude.

The Eclips-  
tyke lyne

The mouing  
of the Sunne  
& the other  
planets in  
the zodiack.



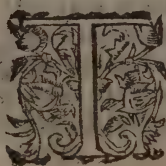
What the  
xii. signes  
are.

The Fig-  
ures of beas-  
tes & other  
thynges  
imagined  
in heauen  
besyde the  
xii. signes.

other whyles toward the south, & sumtymes also thwart  
or trauerse the Ecliptyke. It is lyke wyse to be noted,  
that these signes whereof we haue spoken, are not the  
constellations or starres that make those figures which  
the auncient Astronomers dyd appropriate to certayne  
beastes and other thynges. For these figures are mo-  
ued accordyng to the motion of the eyght sphere, and  
passe from one signe of the Zodiac to an other. As we se  
that the starre called Oculus Tauri, (that is) the Bulles  
eye, is in two degrees of Gemini. And the two starres  
that are the head of Gemini, are in. xiii. & .xvi. degrees  
of Cancer. And Spica virginis (that is) the spyke of the  
Virgin, is in. xvi. degrees of Liba. And the harte of  
Scorpio in two degrees of Sagittarius. And by this or-  
der do they passe from one signe to an other: so that we  
may not vnderstande the signes by these starres, but for  
the. xii. partes of the arke of the Zodiac, takyng the be-  
gynnyng of the Equinoctiall of Aries. The names of  
these signes with theyr carates and qualities, are descri-  
bed in this table here folowyng.

Núbers	Names	Charates	Qualities	Núbr.	names	Char	Qualities
1	Aries.	V	hot & dry.	7	Libra.	Λ	hot & moist.
2	Taur.	♉	cold & dry	8	Scorp.	♏	cold & moist
3	Gemi.	♊	hot & moist	9	Sagit.	♐	hotte & dry.
4	Cancer	♋	cold & moist	10	Capri.	♑	colde & dry.
5	Leo.	♌	hot & drye.	11	Aqua.	♒	hot & moist.
6	Virgo.	♍	cold & dry.	12	Pisces.	♓	cold & moist

## The. xii. Chapter of the Circles called Coluri.



Here are two Circles in the Sphere, cal-  
led Coluri, so named of the Greke worde  
Colon, which signifieth a member: And  
of Vros, whiche signifieth a wyld Dre.  
The taylor of this beaste, maketh a semy-  
circle

circle or halfe circle, not perfecte. And as this beaſt mo-  
ueth his tayle laterally or ſyde wayes, and not by longi-  
tude: euen ſo do the Colurimoue to vs, and are cutte in  
ryght ſphericall angles vppon the Poles of the worlde.  
The one paſſeth by the Poles of the worlde and by the  
Equinoctials, and is called the Equinoctiall Colure: The Equi-  
noctiall Co-  
lure.  
The other lykelike paſſeth by the Poles of the worlde,  
and alſo by the Poles of the Zodiac, and by the Solſtici-  
als, and is called the Colure Solſticiall, called Solſtici-  
um, as Solis ſtatio (that is) the ſtanding or ſtaying of the  
Sunne: becauſe that when the Sunne cometh to this  
poynt, it declineth no more, but returneth towarde the  
Equinoctiall. Theſe circles deuyde alſo well the Equino-  
ctiall as the Zodiac into foure equall partes by the poynt-  
es of the Equinoctials and Solſticials. In the Colure  
Solſticiall are the greateſt declinations of the Zodiac:  
which are two arkcs of this Colure, contained betwene  
the Equinoctiall and the Zodiac. And theſe arkcs are  
equall to the other two of the ſame Colure, included be-  
twene the Poles of the worlde and the poles of the Zo-  
diac.

The Solſti-  
cial Colure.

The greateſt  
declination  
of the zodiac

## The xliii. Chapter of the Meridian Circle.

**T**he Meridian, is one of the great cir-  
cles, imagined to trauerſe the ſphere  
by the poles of the worlde, cuttinge  
the ſame in two equall partes by the  
Zenith or verticall poynt. It is called  
Meridian for this effect: that where  
ſoever a man becometh, and at what  
ſoever tyme of the yeare, when the  
Sunne (by the moving of the ſyſt moveable) ſhal come  
to his Meridian: to hym ſhall it be hygh noone at Mydd-  
day, and is therfore alſo called the circle of the mydday.

Definition  
of the Meri-  
dian circle.

The myds  
day or none

It is



Divers Meri-  
dians.

It is also to be noted, that there are as manye Meridi-  
ans or Meridian lines, as are differences or habitacions  
by longitude: so that they that dwell in the East, haue  
other Meridians then they that dwell in the West. And  
hereby is iudged the distance from one citie to an other,  
and from one region to an other: So that the interposi-  
tion of the arke of the Equinoctial betwene the Meridi-  
an of one citie, and the Meridian of the other, is called  
the difference of longitude from one region to an other,  
and from one citie to an other, as we wll further de-  
clare hereafter.

## The. xiiii. Chapter of the Horizontall Circle.

Definition  
of the Horiz-  
on

Hemispher  
or Horizon

Divers Ho-  
rizons

The ryght  
and oblique  
Horizon



The Horizon (after the Astronomers)  
is a circle that deuidenth the hemisphe-  
re or halfe circle superiour from the  
halfe circle inferiour: Or that deu-  
deth that part of heauen which we see  
from the parte we see not, as the pro-  
fessers of perspective affirme, and is  
also called y Hemisphery (that is) the  
half sphere, as the word signifieth in the Greke tongue,  
and therfore eyther of these halves is called Hemispheriū  
This Horizon is moueable to them that moue. And  
hereof it commeth, that howe many places are vpon the  
earth and the circumference therof: it is possible there  
should be so many Horizons. The Astronomers deuide  
the Horizon into ryght & oblique or crooked. The ryght  
Horizon, is to them whose Zenith or verticall poynt is  
directly in the Equinoctiall: And this ryght Horizon  
passeth by the Poles of the worlde, and deuidenth the  
Equinoctiall in ryght and sphericall angles. The other  
oblique or declined Horizon haue they vnto whom the  
Pole of the worlde doth ryse aboue their Horizon. This  
Horizon is also called oblique, because it deuidenth the E-  
quinoctiall in vnequall and oblique or crooked angles.

Also

Also it is to be understoode, that the pole of the Horizon is called Zenith or the vertical point of heauen, perpendicularly or directly ouer our headde. Whereby is inferred, that as much as is the eleuation of the pole of the worlde aboue the Horizon, so much is the distance of the Zenith from the Equinoctiall. For the Zenith by all his partes, is distant from the Horizon by 90. degrees. And all other impedimentes excluded, we maye euer see halfe the heauen. And in as much as anye shall passe from the Equinoctiall towarde the North or from the South, so muche falleth his Horizon vnder or beneath the pole towarde the course he intendeth, and likewise as muche shall it bee rayised aboue the contrary pole, as shall appeare by a demonstration in the end of this Chapiture. This horizon divideth the Meridian in two partes. That is to say: into East & West. The East is that part of heauen where the starres which the earth hydeth from vs, beginne to aryse to vs and appeare to our sight. For those whiche we saw not before. seme as it were to be newly bozne vnto vs. The West is where the starres come not to our sight, beinge hyd and couered from vs vnder the horizon. It is not fro my purpose to declare howe the East is in two maners, as the one true & the other not true. The true East is the point where the sunne ryseth, the Equinoctiall beyng in the Horizon: Lykewyse is the West in two maners, one true and the other not. The true West is the part where the sunne falleth or goeth downe at the time of the Equinoctial. The vnttrue East is variable accor dyng as the sunne ryseth dayly in dyuers poyntes of the Horizon. And so consequentlye is iudged of the West or Occident.

Distance of  
the zenith  
from the  
Equinoctial

How the Ho-  
rizon diuis-  
beth the Me-  
ridian.

The true &  
vnttrue east  
and west.





## The .xv. Chapter of the foure lesse Circles.

The lesse circles.

**H**aving intreated of the .vi. byggeste Circles, it remayneth to speake of the foure lesse Circles. A lesse Circle (as we haue sayde before) is that whose superficiall deuydeth the Sphere into vnequall partes

equall partes, not passing by the centre therof. And of these, two are named Tropykes, so named of Tropo, the Greke woꝛde which signifieth conuersion : because the Sunne commyng to any of these Tropykes, is conuerted, and turneth towarde the Equinoctial. These Tropykes are describ'd by the motion of the fyrst moueable with the points of the Solstitials. The one with the begynnynge of Cancer, and this is called the Tropyke of Cancer oꝛ Estiuall oꝛ sommer Tropyke. The other is describ'd with the begynnynge of Capricorne, and is called the Tropyke of Capricorne, oꝛ Hiemall oꝛ wynter Tropyke. These two Tropykes and the Polare circles (wherof I wyll saye moze hereafter) are called Paraleles : So named foꝛ that they are equally deuyd'd by theyꝝ circumferences one from an other, and as well fro the Equinoctiall. The Polare circles are describ'd in this maner : so that as the Zodiack declineth from the Equinoctiall, so do the poles of the zodiacke decline from the poles of the woꝛlde. And as the eyght sphere is moued at the motion of the fyrst moueable, so shall the Zodiacke moue, which is part of this sphere. And the Zodiack beyng moued, his poles shall lyke wyse moue about the poles of the woꝛlde. And as the poles of the Zodiack are distant from the poles of the woꝛlde. xxiij. degrees and a halfe (whiche is as much as the greatest declination) they shall descrybe certeyne circles deuyd'd from the poles of the woꝛlde, in the selfe same. xxiij. degrees and a halfe. These Polare circles take theyꝝ name oꝛ domination of that pole of the woꝛlde that is moſte nere vnto them : And therfoze is the one called Artyke, and the other Antartyke.

Tropykes

Paraleles

The Polare circles

The poles of the zodiacke poles of the woꝛlde

The greatest declination of the sunne

Pole Artyke and Antartyke

## The. xvi. Chapiter of the

fyue Zones.

The



The .x. part.

The sphere  
deuided in  
to .v. zones



zones habi-  
table and  
unhabitable

The diuision  
of the earth  
according  
to the fyue  
zones of hea-  
uen

An error of  
Ptolome &  
the Astrono-  
mers

The auncient Astronomers deuyded the sphere into. v. Zones. The fyrste from the pole Artyke to the circle Artyke. The seconde from the circle Artyke to the Tropyke of Cancer. The thyrde from the Tropyke of Cancer to the Tropyke of Capricorne. The fourth from the Tropyke of Capricorne to the circle Antartyke. The fyfth from the circle Antartyke to the pole Antartyke. Of these. v. Zones they had certayne knowledge that the tmo of the poles were unhabitable for extreme colde: and also that the burnt zone called Torrida zona whereby the Sunne passeth by the myddest of them, shoulde be unhabitable for extreme heate. That from the Tropyke of Capricorne vnto the circle Antartyke, they called deserte, because they knewe not that it was inhabited. And this our Zone, that is, from the Tropyke of Cancer to the circle Artyke, they called inhabited or habitable. And to haue moze perfecte knowledge hereof: It is to imagine that the earth is deuided proportionally into. v. regions or portions, which aunswere directly to the sayde fyue Zones, as saith the Poete Diuide in this verse.

Totidemq3 plagē, tellure præmuntur. That is. And so many regions are on the earth beneath.

Euery of these regions or portions of the earth, is situate vnder one of the. v. Zones aforesayde. But wheras certen men of auctoritie haue moued the question, whether the earth vnder the Zone frō the Tropyke of Cancer to the circle Antartyke, is desert or no: Ptolomie & the Astronomers affirme that it is vnpeopled. But Aristotle, Diuide in the seconde of his Metamorphoses, Plinie also, and Ihon de Sacro bosco affirme the contrarye: As for the moze certentie therof, we knowe by theperience of suche as go and come daylye from those partes. Mozeouer then this, we know that that land is not only well replenished with people of good corporature, & of whyte colour, but y same to be also very ryche in gold. For they that sayle to the East Indies, touch in y cape of Buena

Buena speranza 02 Caput bonæ Spei, which is in this zone. Like wylse the lande of Brasile, and the confines of Rio de la Plata, with al the coaste vnto the straighes of Magalians, euen vnto the. liiii. degrees of the South parte. This land was discovered by Magalians, in y<sup>e</sup> yeaere. 1520 02. 1521. Wherby that is nowe well knownen by sight, wherof Ptolomie had no knowledge by hearesaye. The burnt zone (cauled Torrida zona) they also discribed to be vnhabitable by reason of the great heate therof, as Aristotel, Plinie, and in maner all other ancient autours as firme: wherof the Poet Virgil writeth thus.

The land of Brasile.

The straighes of Magalians.

Quinque tenent Coelum zonæ: quarum vna cornusco

Semper sole rubens: et torrida semper ab igne.

Whiche in the englische tonge, is thus muche to saye in effect.

In zones fīue the heauens contained be,  
Wherof the one with burning sunne is red,  
Scorching so the earth subiect to his degree,  
That for the heate therof it is vnhabited.

Like wylse Ouide in his Metamorphoseos, toucheth the same, saying.

Quarum quæ media est, & torrida semper ab igne &c.

Yet that the burnt zone is inhabited and well replenished with people that liue there, we knowe so certainly by the number of them that daily passe to and fro the Indies of your maiestie discovered in your most happy daies that to say any thing to the contrary it should bee a manifest errour. And therefore is it greatly to bee marueyled, that certayne wylse menne haue affyrmed these partes to be vnhabitable: where as neuerthelesse they had knowledge of Arabia Felix, Aethiopia, Taprobana, and diuers other Regions situate vnder the burnt zone. Plinie writeth that a shippe came from the Sea of Persia by the Ocean rounde about Ethiope, and came to the pillers of Hercules: whiche is nowe the citie of Cadiz, where at this present I wyte this brieue treatyse. They of Guinea, Calicut, Gatigara, and Malaca, liue all vnder the burnt zone: and many of the liue very long. And that, that part is inhabited, S. Isidore saith that Paradise

The west Indies.

People of long life vnder the zone.



terrestriall is a place situate in the East, very neare vnto the circle of the Poone: moste temperate, and full of al pleasure and delite. And doubtlesse many thinges ought to perswade vs, that vnder the burnt zone, the earth is furnished with al thynges perteyning to the life of mā.

First for that in that region or portion of the earth, is in maner continuall equinoctiall: and the coldnesse of the nyght doth sufficiently temper the heate of the daie. Secondly, bycause Saturne, Mercury, and the Poone, whiche are colde and moyst Planetes, are of great force in regions vnder that Zone & passe directly ouer them.

Colde and  
moyst plan-  
etes, temper  
the heate of  
the burnt zo-  
ne.

Againe, they y inhabite vnder that zone haue two sommers & two wynters in the yeare. Wherby is cōcluded that y aunciet autours erred, not only in affirmyng this zone to be vnhabitable by reason of y great heate thereof, but in lyke maner erred in affirming the zone that is betwene the circle Articke & the pole Articke, to be also vnhabited by reason of great colde. The contrarie wher

Colde regi-  
ons habita-  
ble.

Islande.  
Gothlande.  
Norwayne.  
Russia.

of we may well affirme, knowyng as we knowe, that Isle, with parte of Gothlande, Norwayne, Russia, and diuers other landes are inhabited and well peopled.

**T**his is the figure and demonstration  
whiche foloweth.

The



**The. xvii. Chapter of longitude and latitude: and of the proportion which the lesse circles haue to the great Circle.**

**T**he Sphere is deuised in Latitude by degrees in this maner: So that from the Equinoctiall to either of the poles, is, 90. degrees. And in longitude by the Equinoctiall, it is deuised into three hundredeth and three score, as is sayde in the diuision of the Zodiack. And from these degrees, passe certain great circles (called Meridians) to the poles of the world.

C. ii.

These

The diuision  
of the sphere  
by longitude  
and latitude.



The degrees  
of the equis-  
noctial cir-  
cle.

These diuide every parallell or lesse circle into. 360. degrees. But we must not vnderstand these degrees to be equall: (that is to meane) as great in one circle as in another. Neither are they in a lesse circle as great as in a great circle. So that every degree of the Equinoctiall, containeth in longitude. 60. minutes, because they are degrees of the great circle, as are all the degrees of latitude from North to South, or from one pole to another, as well in the heauens as on the superficiall part of the earth and water. The other degrees of Longitude, as they go by parallels distant from the Equinoctiall, and come neare to either of the poles, diminish consequently more and more: And haue vnto seuen degrees. 59. minutes and certen secondes for a degree of longitude. And vnto. 12 degrees haue. 58. min. And to. 16. 57. min. And so furth, as shall appeare in a briefe table that shall folowe after this chapter. So that multiplying every degree by the minutes whiche it shall containe according to the circle of his parallell: and the sum of them that yse therof diuiding by. 60. that then remaineth, shalbe the degrees of the great circle.

**T**he table of minutes whiche euery degree con-  
teineth in euery of the paraleles.

[illegible]

**The. xviij. Chapter of the circuite of  
compasse of the earth and water, according to the  
opinions of the ancient and later  
Auteurs.**

**I**T may here appeare to make for our purpose to declare how the auncient wyters counted the degrees of the earth and water. First the Latines counted by myles. *myles.* The Grekes by furlonges. *furlonges.* The Spaniards and Frenchemen by leagues. *Leagues.* The Egyptians by signes or markes: and the Persians by saguas. But they all agree that foure graines of barley make a synger: foure fingers a hande: foure handes a foote: fyue feete a geometrical pase (for two simple pases make fyue feete) Also. 125. Geometricall pases, make a furlong. viij. furlonges one myle, whiche is a thousand pases. And thre myles one league. In Germanie they make leagues of moze feete: and in some places moze then in other. In Fraunce they count. xvi. leagues to one degree. The Spanyardes counte. xvi. leagues and two terces: and. xvij. and a half for a degree of the great circle. This difference that one league is bigger then another, may come hereof, that one barley corne is bigger then another. But to our purpose, let vs gyue to euery league, thre thousand pases, and to euery pase fyue foote, and so shall euery league haue fyue thousand foote. In the cartes of the sea that haue their degrees of. xvi. leagues and two terces, we say that of these, the roundnes of the lande and the water containeth fyve thousand leagues. And in the cartes that haue. xvij. leagues & a halfe for a degree, of these we say that it containeth fyve thousand and thre hundred leagues. And who so desireth to knowe how much is the Diameter of the earth and water, may knowe it by multipling the circumference by seuen: So that diuiding the summe that riseth therof by twenty and two, the parte that riseth of that calculatio, shalbe the Diameter: and the halfe therof shalbe the semidiameter.

*Grayns.  
Fingers.  
Foote.  
Pase.*

*The degree  
of the Sea  
cartes.*

*The Diamete  
ter of the  
earth & wa-  
ter.*



# The. xix. Chapter of the seuen Climates.

Division of  
the earth and  
water by cli-  
mates.



Diversity of  
things  
in diuers cli-  
mates.

What is a  
climate.

Difference  
of dayes.

The space of  
the seuen cli-  
mates.

The quanti-  
tie of the les-  
ser circles.

The auncient autours diuided the su-  
perficall of the earth and water from  
the Equinoctiall towarde the part of  
the North, into seuen climates, with  
eyght lynes equally diuided from the  
Equinoctiall. In these climates are  
dyuers condicions and customes of  
men, and dyuersities of beastes and  
other naturall thynges. And for y<sup>e</sup> parte of the world  
whiche they counted habitable, is comprehended vnder  
the. 180. degrees of longitude: and. 37. degrees and. 45.  
minutes of latitude, we force not to assigne the climates  
in this maner: but compassyng about the whole vniuers,  
fall lande and sea, diuiding the parallele circles. A climate  
or climat, is a space of lande in the whiche the greatest  
daye maketh difference of halfe an houre. So that in  
seuen climates, shalbe the difference of thre houres and a  
halfe. The greatest daye is from the begynnyng of the  
first climate. xii. houres and. 45. minutes. And in the  
ende of the seuenth climate, the greatest daye shalbe of.  
xvi. houres and fyue minutes. These climates do not be-  
gynne in the Equinoctiall. But the begynning of the  
first climate, is distant from it. xii. degrees and. 45. mi-  
nutes: And the ende of the seuenth climate, is distante.  
50. degrees and. xxx. minutes. So that the space whiche  
the seue climates do occupie, shalbe. 37. degrees and. 45.  
minutes. In lyke maner is to bee vnderstoode, that  
the longitude of the first climate, is greater then the lo-  
gitude of the seconde: and that of the seconde then that  
of the thirde: and so of the reste. For the lesse circles in  
howe muche they are nearer to the Equinoctiall, in so  
muche are they greater. And in howe muche nearer to  
the pole, so much shal they be the lesse, bicause the sphere  
is narrower and narrower towarde the pole, and conti-  
nually wareth straighter at the concourse of the Peri-  
dians.

clians. In lyke maner shall you vnderstande, that greater is the breadth of the first climate then of the seconde: and the seconde then the thyrde, and lykelypse of the other. For in howe muche the more from the Equinoctiall you come neare to the pole, so muche the more is the sphere oblique or crooked, and consequently the daye encreaseth more. By reason wherof, in lesse space is found thyncrease of halfe an houre, in whiche the climate maketh difference and doth varie. Whiche thynge shalbe more manifest to hym that beholdeth the latitude of the all, as may appeare by the Table here followyng: In whiche you may se the houres whiche the greatest days conteyneth of euery climate in his begynning, myddest, and ende: with also the eleuations of the pole, or distaunce from the Equinoctiall: and also the degrees of latitude whiche euery climate conteyneth.

The latitude  
of climates.

Climates.	Beginning		Myddest		Ende		Beginning		Myddest		Ende		Latitude.	
	Ho.	M	Ho.	M	Ho.	M	Ho.	M	Ho.	M	Ho.	M	Ho.	M
First.	12	45	13	0	13	15	12	45	10	40	20	30	7	40
Seconde.	13	15	13	30	13	45	20	30	24	15	27	30	7	0
Thirde.	13	45	14	0	14	15	27	30	30	45	33	40	6	10
Fourth.	14	15	14	30	14	45	33	40	36	24	39	40	5	20
Fifth.	14	45	15	0	15	15	39	40	41	20	43	30	4	30
Sirth.	15	15	15	30	15	45	43	30	45	40	47	15	3	45
Seuenth.	15	45	16	0	16	15	47	15	48	40	50	30	3	15

The first climat, is called Diameroes. Meroe is a citie of Aphyke vnder the burnt Zone on this syde the Equinoctiall. xvi. degrees.

Diameroes.

The second is called Diasyena. Syena is a citie in the confines of Ethiope: where there is a well that sheweth the Sommer solstitial: bicause that place is vnder the circle of the Tropike of Cancer, and the Sunne seemeth to stande directly ouer that place at midday of y<sup>e</sup> solstitiall. Wherby the well is then very cleare, and hath in it no shadowe at all: as the Poet Lucan maketh mention in Farsalia, where he saith.

Diasyena

Vmbras nulquam flectentes.

That is to say: shadows no where reflecting.

C. iiii.

The



**Dia Alexandros.**  
**Dia Rhodos.**

**Anyghtes of the Rhodes.**

**The Rhodes taken by the Turke.**

**Dia Rome.**

**Dia Boristhenes.**

**Dia Rifeos.**

**The ryuer Tanais.**

**Stollerine.**

**The West: or South climates.**

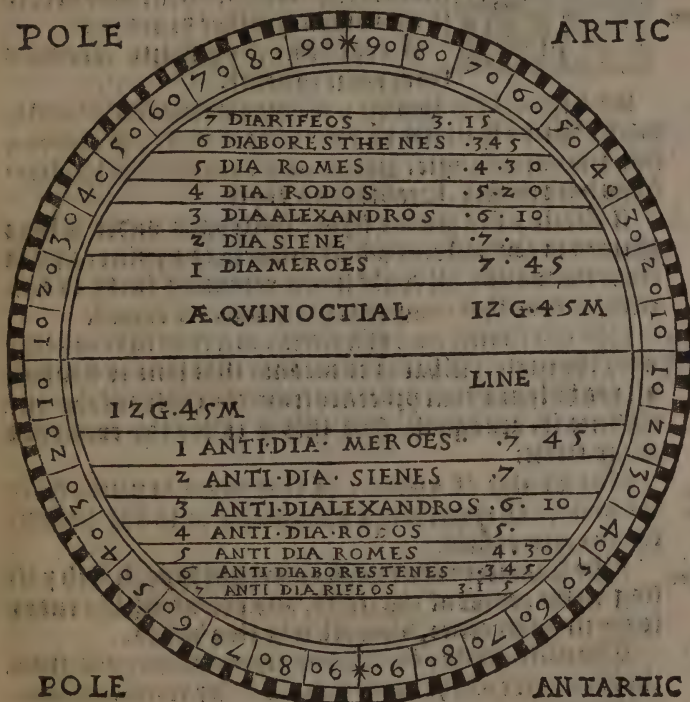
The third is **Dia Alexandros**. Alexandria is a famous citie in Aphrike, buylded by great Alexander: and is the chief citie or Metropolis of Egypt. The fourth is **Dia Rhodos**. Rhodes is an Iland of Asia the lesse, where were sumtyme the knightes of the Rhodes, called the knightes of the order of S. John, or knightes of Jerusalem. Who were driuen from thence when the Iland and citie was taken by Soltan Suliman the great Turke, in the yeare 1522: Philippe Vlerio Frenchman, being then graund maister of the Rhodes. Within this fourth climate, is the citie of Jerusalem within the holy lande called Palestina and also a great part of Spayne, with many other prouinces.

The fift is **Dia Rome**, Rome is the most famous citie of Italie, and most notozious of all Europe. Sumtyme the head of the world, dominatrix of nations, and now the see of the byshop of Rome.

The sirt is **Dia Boristhenes** Boristhenes is a great ryuer of Scythia: the fourth arme of the ryuer Istro. It fauleth into the sea Euxinum. And where as all other ryuers of Scythia are troubled, this is cleare and faire. Also holsum to be dronke, and full of fysh.

The seuenth and last climat, is called **Dia Rifeos**. The mountaines called Rifei, are famous in the parte of Europe cauled Parmitia: and are continually couered with snowe. Out of these, springeth the ryuer Tanais, well knowen in the world by fame. When it is wytted with ph. it is the name of certen mountaines of Archadia. And here ought we not to be ignorant, that wheras the ancient autours assigned only seuen climates, they myght haue made many more. And for that they iudged the part of the pole Antartike not to be inhabited, they assigned no climates therto. Stollerine added the eight climate, counting from thende of the seuenth climate vnto 57. degrees: and other added more. In like maner describing Meridionall or South climates, we caule them by the selfe same names as we did the aforesayd Septentrionall or North climates: sauing that it is necessary to put before euery of them this Greke preposition Anti, which

whiche in the Latin tongue signifieth Contra, or Contra-  
rium (that is) contrarie or against. So that as we named  
the first North climat Dia Meroes, we must to the first of  
the South, adde this worde Anti: & so shall the first South  
climate be named Anti Diameroes: The seconde Antidia  
syenē, and so furth of the other, as is seene in the figure  
here folowng.





# The. xx. Chapter of certen principles that ought to be knowen for this science.

A ryght line

An angle.

Solide.

A Circle.

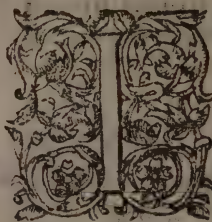
The circumference of a Circle.

The center of a circle.

Diameter

Semicircle.

Zenith.



In treating of the Sphere, we have spoken of Circles, Circumferences, Centers, Diameters, Lines, with such other wordes appropriate to this science. The whiche: what they are, it is convenient further to declare.

A ryght line, is a shorthe extention from point to point.

An angle, is the touching of lynes in one superficiall, whose touche shall not be direct: for if it be, it shalbe a line and not an angle. Solide, is a body whiche by dimensions hath length, breadth, and depth.

A Circle, is a playne figure conteyned vnder a lyne drawen in compasse: in whose middell, is a point or prick from the whiche all ryght lynes comming furth to the circular lyne that compasseth it about, are equall.

The Circumference of a circle, is a lyne that conteyneth the circle. (That is to meane) that lyne to which all ryght lynes that proceade from the center of the circle vnto it, are equall. And this is called the roundnes of the circle.

The Center of a circle, is that point or pricke from the whiche all ryght lynes proceading vnto the circumference, are equall.

The Diameter of a circle, is a ryght lyne, which passing by the center of the circle, and extending his endes to the circumference, diuideth it in two halfes.

The halfe circle, is a playne figure conteyned from the Diameter of the circle and the halfe circumference.

Zenith is a point or pricke imagined in heauen directly ouer the top of any thyng. As if we should imagen a ryght lyne to passe by the center of the earth, extended from thence directly to heauen, and passing through the feete and head of a man standing by ryght, so that the extremities or endes of this lyne should reache vnto & touch the the

the the circumference of heauen : then the imagined point  
 or pntcke of heauen where the ende of the lyne toucheth,  
 is called Zenith, or poynt of the head, or vertical point.  
 The same is to be vnderstode of a citie or any other thing  
 when we speake of  $\hat{y}$  zenith therof. Eccentricke, is a circle Eccētricks  
 which hath his center distant or diuided frō the center  
 of the worlde: and is describ'd in the heauen of the sunne  
 imagining a lyne from the center of the Eccentrike to  
 the center of  $\hat{y}$  Sunne: And is moued one whole reuolu-  
 tion at the proper motion of the Sunne. In the other  
 heauens, imagining a lyne from the center of his Eccen-  
 trike to the center of his Epicycle: & is moued a whole re-  
 uolution at the proper motion of the Epicycle.

The Epicycle, is a circle or litle rouēdel first in the depth Epicycle  
 of the Eccentrike: In whiche the Planet fixed and nere  
 to his center, is moued circularly.

The Auge, is a poynt in the circumference of the Ec- Auge  
 centrike, very neare to the firmament. Or it may bee  
 sayde, that the Auge is a poynt furthest distant from the  
 earth. Aux in the Greke tongue, is as much to saye as  
 the largest lōgitude, or greatest eleuation frō the earth.

The Opposite of Auge, is an other poynt in the cir- Opposite of  
 cumference of the Eccentricke: nearest vnto the  
 earth, and furthest distant from  
 the firmament.

Here endeth the first part.



## THE SECONDE PARTE

intreatyng of the Motions of the Sunne,

and the Moone: And of the effectes

caused thereby.

### The first Chapter of the course of the Sunne in the Zodiac: And of the effectes caused by the same.



The sunne  
is the guide  
in navigation

The moving  
of the sunne  
vnder the 30:  
diack.

Equinoctial.

The summer  
Tropike.

Declination  
of the sunne.

We haue briefly spoken of  
the Sunne and of the other beaueus.  
But for as muche as the Sunne must  
be our marke, gyde, and gouernour in  
nauigation, whereof we intende to  
gyue perfect instructions, it shal be ne-  
cessary especially and precisely to de-  
clare the course and motions therof. Therfore (as we  
haue sayd) the Sunne is moued vnder the Zodiac, and  
vpon his poles by the line Eclipticke, passing by the. xii.  
signes, beginning in the first degree of Aries, where he  
maketh the Equinoctial, when the dayes and nyghtes ar  
equall to all. And passeth by this signe to vs that are  
on the North parte: wherby the length of the dayes are  
encreased with vs, and the length of the nyght are shor-  
tened. Then entreth he into Taurus. And passing by it,  
entreth into Gemini. Then passing by it and entereng  
into the first degree of Cancer, he toucheth in the Summer  
or estiuall Tropike: and then are the dayes longest with  
vs, and the nyghtes shortest. Then declineth he no fur-  
ther from the Equinoctiall: but returnyng towarde it,  
passeth by this signe, shorTENyng the dayes to vs & leng-  
thening the nyghtes. From this signe of Cancer, it en-  
tereth into Leo: and passeth by it into Virgo. And by it  
entereth into the first degree of Libra in the Equinoctiall:  
and there maketh the other Equinoctiall, when to all,  
the nyght is equall with the daye. And passing by this  
signe, goeth declining from the Equinoctiall towarde  
the

the pole antartike: increasynge the nyghtes to vs & shortenynge the dayes: and so entreth into Scorpio: and from thence into Sagittarius. And passynge by it, entreth into the fyrst degree of Capricorne to the Hyemal or wynter tropicke. And then are the longest nyghtes vnto vs, and the shortest dayes. From hence he retourneth towarde the Equinoctiall, shortenynge vnto vs the nyghtes and lengthenynge the dayes. He passeth by this signe of Capricorne and entreth into Aquarius. And passynge by it, entreth into Pisces. And passynge from thence, retourneth to his fyrst poynt of the equinoctial of Aries where he began. Hereby it foloweth, that as the Sunne goeth the half of the zodiack on this part of the equinoctiall, & the other halfe on the other parte of it, & in these halfes hath diuers declinations, is caused the increasynge or decreasinge of the dayes and nyghtes to one more and to another lesse, accordynge as euery one with his Horizon discovereth of his course of the Sunne by his little or much that he is departed or dissaunt from the equinoctiall, or as the pole is raysed aboue his Horizon. So that, when as to them that are on this parte of the equinoctiall, is the longest daye and the shortest nyght: euen so to them on the other part, is the longest nyght and shortest day. And contrariwise, when vnto vs is the shortest day, vnto them is the longest. Whiche shall further appeare by euident demonstration in the last chapter of the thyrde parte.

The wynter  
tropike.

The cause of  
increasinge &  
decreasinge  
of the dayes  
and nyghtes

The discrete reader shall here note that the Sunne is moued regularly in the center of his sphere: whose center is without the center of the worlde towarde the part of Cancer. Wherby the sunne passing in his Septentrionall signes, is more distant from the earth: and hath more to go then in the south signes. And for this cause it tarieth nyne dayes more on the part of the Auge then on his opposite. And hereby it foloweth that by reason of the obliquitie or crookednesse of the zodiack, certen dayes of wynter with their nyghtes, are longer then certayne other of somer with their nyghtes.

The mouing  
of the sunne  
in the center  
of his sphere

The



## The. ii. Chapter of the true place of the Sunne in the Zodiack.

To finde the  
true place of  
the sunne,



The equatio  
of the yeare,

The true place of the Sunne, is a point  
or prick in the Zodiack, which is thus  
founde: That drawing a ryght lyne  
from the center of the worlde to the  
center of the Sunne, and carying the  
same continually ryght furth vnto the  
Zodiack where this line sheweth or  
toucheth, that is the true place of the

Sunne. This place is founde in thre maners. One  
waye by a table. An other waye by an instrument: And  
the thyrde waye by a certaine rule to be bozne in memo-  
rie. To fynde the true place of the sunne by a table, seke  
in the table folowynge, the moneth that you are in, in the  
fronte or head of the table: And the dayes of the moneth,  
on the left syde of the table. Then directly against the  
dayes, vnder the title of the monethes, you shall fynde  
two numbers which are the degrees and minutes of the  
signe whiche you shall fynd named ouer the head  
or aboue the sayde numbers. Then to the degrees and  
minutes whiche you shall fynde, you shal adde the equa-  
tion that is directly of the yeare in the whiche you are, or  
seeke to knowe. And this shall you seeke in the table of  
equations whiche is after this. And that whiche doth a-  
mount or arise therof, shalbe the true place of the sunne.  
And here is to be noted, that in the comō yeares, (whiche  
are they that haue not the bisertile or leape yeares,) frō  
thende of Februarie vntill thende of the yeare (I saye  
of December), shal euer one degree be diminished or ta-  
ken away. And the degrees and minutes that shall re-  
mayne, is the true place of the sunne. Nowe to

knowe this by an instrument and by me-  
mozie, shalbe sayde in the se-  
uenth Chapter.

## The Table of the true place

Do- neths.	January	February	Marche.	April.	Maye.	June.
Sig- nes.	Capric.	Aquarius	Pisces.	Aries.	Taurus.	Gemini.
Dates	G	M	G	M	G	M
1	20	22	21	53	20	55
2	21	24	22	54	21	55
3	22	25	23	54	22	54
4	23	26	24	55	23	54
5	24	27	25	55	24	53
6	25	28	26	56	25	53
7	26	30	27	56	26	52
8	27	31	28	56	27	52
9	28	32	29	57	28	51
10	29	33	0	57	29	50
11	0	35	1	57	0	49
12	1	36	2	58	1	48
13	2	37	3	58	2	47
14	3	38	4	58	3	46
15	4	39	5	58	4	45
16	5	40	6	58	5	44
17	6	41	7	58	6	43
18	7	42	8	58	7	42
19	8	43	9	58	8	41
20	9	44	10	58	9	39
21	10	45	11	58	10	38
22	11	46	12	58	11	37
23	12	47	13	57	12	36
24	13	48	14	57	13	34
25	14	48	15	57	14	33
26	15	49	16	56	15	32
27	16	50	17	56	16	30
28	17	51	18	56	17	29
29	18	51	19	56	18	28
30	19	52			19	27
31	20	52			20	25
					18	58



The. 2. part.

# Of the Sunne.

No. neths.	June.		August.		September.		October.		November.		December.	
Sig- nes.	Cancer.		Leo.		Virgo.		Libra.		Scorpio.		Sagitta.	
Dies	☾	☿	☾	☿	☾	☿	☾	☿	☾	☿	☾	☿
1	18	26	18	2	18	4	17	39	18	49	19	24
2	19	23	19	0	19	2	18	39	19	50	20	26
3	20	20	19	58	20	1	19	38	20	51	21	27
4	21	17	20	55	21	0	20	38	21	52	22	29
5	22	14	21	53	21	58	21	38	22	53	23	30
6	23	11	22	51	22	57	22	38	23	54	24	31
7	24	8	23	48	23	56	23	38	24	55	25	33
8	25	5	24	46	24	55	24	38	25	56	26	34
9	26	2	25	44	25	54	25	39	26	57	27	36
10	27	0	26	42	26	53	26	39	27	58	28	37
11	27	57	27	40	27	52	27	39	28	59	29	39
12	28	54	28	38	28	51	28	39	0	0	0	40
13	29	51	29	36	29	50	29	39	1	1	1	42
14	0	48	0	34	0	49	0	39	2	3	2	43
15	1	46	1	32	1	48	1	40	3	4	3	45
16	2	43	2	30	2	47	2	40	4	5	4	46
17	3	40	3	28	3	46	3	40	5	6	5	48
18	4	38	4	26	4	45	4	41	6	8	6	49
19	5	35	5	24	5	45	5	41	7	9	7	51
20	6	32	6	22	6	44	6	42	8	10	8	52
21	7	30	7	21	7	44	7	42	9	11	9	54
22	8	27	8	19	8	43	8	43	10	13	10	55
23	9	25	9	17	9	42	9	43	11	14	11	57
24	10	22	10	16	10	42	10	44	12	15	12	58
25	11	20	11	14	11	41	11	45	13	16	13	59
26	12	17	12	13	12	41	12	45	14	18	15	1
27	13	15	13	11	13	41	13	46	15	19	16	2
28	14	12	14	10	14	40	14	47	16	20	17	3
29	15	10	15	8	15	40	15	47	17	22	18	5
30	16	07	16	7	16	39	16	48	18	23	19	6
31	17	5	17	5			17	49			20	7

# The Table of the Equations of the Sunne.

The percs of our lozd		The equatio to be added		The percs		The quation		The percs		The quation		The percs of our lozd		The equatio to be added	
6	9	6	9	6	9	6	9	6	9	6	9	6	9	6	9
1545	R 1	0	1581	1	16	1617	1	32	1653	1	48				
1546		45	1582	1	1	1618	1	17	1654	1	33				
1547		30	1583		46	1619	1	2	1655	1	18				
1548		15	1584		32	1620		47	1656	1	3				
1549	1	2	1585	1	18	1621	1	33	1657	1	49				
1550		47	1586	1	3	1622	1	18	1658	1	34				
1551		32	1587		48	1623	1	3	1659	1	19				
1552		18	1588		33	1624		49	1660	1	4				
1553	1	4	1589	1	19	1625	1	35	1661	1	51				
1554		49	1590	1	4	1626	1	20	1662	1	36				
1555		34	1591		49	1627	1	5	1663	1	21				
1556		19	1592		35	1628		51	1664	1	7				
1557	1	05	1593	1	21	1629	1	37	1665	1	53				
1558		50	1594	1	6	1630	1	22	1666	1	38				
1559		35	1595		51	1631	1	7	1667	1	23				
1560		21	1596		37	1632		53	1668	1	9				
1561	1	7	1597	1	23	1633	1	38	1669	1	55				
1562		52	1598	1	8	1634	1	23	1670	1	40				
1563		37	1599		53	1635	1	8	1671	1	25				
1564		23	1600		39	1636		54	1672	1	10				
1565	1	9	1601	1	25	1637	1	42	1673	1	56				
1566		54	1602	1	10	1638	1	25	1674	1	41				
1567		39	1603		55	1639	1	10	1675	1	26				
1568		25	1604		40	1640		56	1676	1	12				
1569	1	11	1605	1	26	1641	1	42	1677	1	58				
1570		56	1606	1	11	1642	1	27	1678	1	43				
1571		41	1607		56	1643	1	12	1679	1	28				
1572		26	1608		42	1644		58	1680	1	13				
1573	1	12	1609	1	28	1645	1	44	1681	R 2	0				
1574		57	1610	1	13	1646	1	29	1682	1	45				
1575		42	1611		58	1647	1	14	1683	1	32				
1576		28	1612		44	1648	1	0	1684	1	15				
1577	1	14	1613	1	32	1649	1	46	1685	2	2				
1578		59	1614	1	15	1650	1	31	1686	1	47				
1579		44	1615	1	10	1651	1	16	1687	1	33				
1580		29	1616		46	1652	1	2	1688	1	18				



This Table of the Equation of the Sunne, serueth from the yeare of. 1545. where it hath his roote or beginning, vntyl. 1680. And in the yeare of. 1681. it shall returne to the roote, adding therunto one degree more. As for example. In the yeare of. 1681. adde one degree vpon the other degree that the roote hath, and so shall the yeare of. 1681. haue two degrees of equation. And the yeare of. 1682. shall haue one degree and. 45. minutes: which is to adde one degree vpon. 45. minutes that had the yere of. 1546. &c. And hauing passed other. 136. yeares, you shall returne to the roote, adding two degrees.

### The thyrde Chapiter of the declination of the Sunne.

What is the  
declination  
of the Sunne



The declination of the Sunne, is the arcke of the greater circle, which passeth by the Poles of the world, included betwene the Equinotiall and the Zodiac. And here is to be noted, that whatsoeuer foure poyntes or prickes shall be equally distant from the Equinotials, haue equall declinations.

Wherof it foloweth, that the foure quarters of the Zodiacke haue equall declinations. And to auoyde prolixitie, I wyll adde hereunto a table of the declinations of onely one quarter of the Zodiac: so that all hauing one self same maner of declinations, it may serue for al, and the order of it is this. The signes whose declination increaseth, are in the head or fronte of the Table, and the degrees of these signes descende by the left syde thereof. And the signes whose declination decreaseth, are in the foote of the Table, and the degrees of these signes, ryse by the ryght syde of the same. The disposition of the Table being vnderstande: then to knowe what declination the Sunne hath in euerye degree of the Zodiac, you ought to knowe the true place of the Sunne (as in the Chapiter past is declared) for the day of the declination whiche you desyre to knowe. And the signe whiche

Sig- nes.	♊	♋	♌	♍	♎	♏	♐	Sig- nes.
	♈	♉	♊	♋	♌	♍	♎	
0	0		11	30	20	12	30	
1	0	24	11	51	20	25	29	
2	0	48	12	12	20	37	28	
3	1	12	12	33	20	49	27	
4	1	36	12	53	21	0	26	
5	2	0	13	13	21	11	25	
6	2	23	13	33	21	22	24	
7	2	47	13	53	21	32	23	
8	3	11	14	13	21	42	22	
9	3	35	14	32	21	51	21	
10	3	58	14	51	22	0	20	
11	4	22	15	10	22	9	19	
12	4	45	15	28	22	17	18	
13	5	9	15	47	22	25	17	
14	5	32	16	5	22	32	16	
15	5	55	16	23	22	39	15	
16	6	19	16	40	22	46	14	
17	6	42	16	57	22	52	13	
18	7	5	17	14	22	57	12	
19	7	28	17	31	23	3	11	
20	7	50	17	47	23	8	10	
21	8	13	18	3	23	12	9	
22	8	35	18	19	23	15	8	
23	8	58	18	34	23	19	7	
24	9	20	18	49	23	22	6	
25	9	42	19	4	23	24	5	
26	10	4	19	18	23	26	4	
27	10	26	19	32	23	28	3	
28	10	47	19	46	23	29	2	
29	11	9	19	59	23	30	1	
30	11	30	20	12	23	30	0	
Sig- nes.	♋	♌	♍	♎	♏	♐	Sig- nes.	

whiche the Sunne shall be founde in that day, shall you seke in the front or foote of the table. And yf it be in the front, you shall seke the number of the degrees on the left syde. And if it shall bee at the foote of the table, you shall seke it on the right syde. Then aboue or vnder the signe in the front of that degree of the sayde signe, you shall finde two nũbers: wher of the fyrst is of degrees, and the seconde of minutes: and those degrees & minutes of declinatyon hathe the Sunne that daye. And this is vnderstode without hauyng respect to the od minutes aboue the degree, whiche the true place of the Sunne hath.

And yf you desire to verifie this more p̄cyselye, note the declinatyon of that degree, & of the degree following:



looyng: and take the lesse from the moze. Then of the reste take suche parte as are the minutes that it hadde of. 60. And this parte of minutes muste be added to the fyrst equation of it, and be lesse then the seconde, or must be taken from it, if it shalbe greater: and that then representeth therof, shalbe the p[re]cise declination for that signe, degree and minute. As for example.

In the yere. 1546. the tenth daye of September, the Sunne shalbe in. 26. G. 38. M. of Virgo: and to the. 26. G. p[re]cise, shall corresponde. 1. G. 36. M. of declination. And to verifyshe the declination that cometh to. 38. minutes, which is moze of the. 26. G. you muste marke the difference that is frō the declination of 26. G. (which is one G. 35. M.) to the declination of. 27. G. which is 1. G. 12. M. The difference is. 24. M. Of these you must take such part as is. 38. of. 60. which are almoste twoo terces. Then two terces of. 24. are. 16. which muste be taken of one. G. 36. M. which corresponde to the. 26. G. of Virgo: because the declinations go decreasynge, and remaineth. 1. G. 20. M. And if the declinations increase, you must adde thereto, as you take away when they decrease.

¶ An other example for this yere of. 1561.

Example for the yere. 1561. the. xx. of Apryl  
I find the true place of the Sunne at none in. 9. degrees 54. minutes of Taurus: Then in the Table of signes present I seke for the ninth degree of Taurus, to which doth aunswere for the declination. 14. degrees. 32. minutes: and to the next degree folowing, doth aunswere. 14. degrees. 51. minutes. Then take the lesser out of the moze: so resteth. 19. minutes. Then frame a rule of. 3. & say: yf. 60. minutes geue. 54. minutes (which. 54. minutes doth rest before of the. 9. degree of Taurus) how many doth. 19. minutes geue: which. 19. minutes are the diuersitie of the ninth and tenth degrees of Taurus. So I find that. 19. minutes, geueth. 17. minutes & 6. secūdes which. 17. mi. & 6. secūdes, I adde to the. 14. degrees. 32. minutes which answereth to the. 9. degrees of Taurus:

And

And that commeth to. 14. degrees. 49. minutes, and, 6. secondes, which is the true declination for the. 20. daye of Apryll. Anno. 1561.

It is also to be noted that I adde these. 17. minutes and 6. secondes, because the declination doth encrease: for if it decreased, it were to be taken out so much, and the rest is the declination. So is the declination for the. 20. of Apryll in the yeare. 1561. 14. degrees. 49. minutes, and. 6. secondes.

### The. iiii. Chapiter of the entraunce of the Sunne into the. xii. signes. And of the Equinoctials and Solstitials which deuyde the foure tymes of the yeare.



If that is sayde in the Chapiter befoze, it foloweth that the Sunne enter yng into the foure principall signes, causeth the foure tymes of the yeare. For enter yng into Aries, it chaungeth the tyme to be from wynter to the sprynge tyme. And enter yng into Cancer, it chaungeth the time from spring to Sommer: And enter yng into Libza, from Sommer to Autumne. Lyke wyse enter yng into Capricorne, it chaungeth from Autumne to Wynter. So that when to be that be on the part of the North is Sommer, then is it Wynter to them that are on the South part. Or contrary wyse, beyng Sommer to them on the South, it is wynter to them on the North. The entraunce of the Sunne into these signes, and all other of the Zodiac, hath not ben euer at one selfe same tyme of the yeare. The cause of this is, that the Latine yeare is not equall with the mouyng of the Sunne in the Zodiac: as shalbe sayde in the. x. Chapiter, where we wyll entreate of the yeare. In the tyme that Chyfte our redeamer was borne, were the Equinoctialles. The one at the. viii. of the kalendes of Apryll, and the other at the. v. of the kalendes

The entraunce  
of the Sunne  
into the foure  
principall  
signes.

The latine  
yeare.

The Equi-  
noctials in  
the yeare of  
Chyftes  
birth.



The Solsti-  
cials.

Four nota-  
ble thynges

To knowe  
more precise-  
ly the entre-  
raunce of the  
Sunne into  
the foure  
principall  
signes.

lendes of October: So that they had the Equinoctiall of the spring, at the .xxv. of March: and the Equinoctiall of Autumne, at the .xxvii. of September, as wytteth John Baptist Capuano vpon the seconde Chapiter of the sphere of Iohan. de sacro bosco. They iudged then the Solsticials: as that of the Sommer, at the eyght day of the kalendes of July, whiche is the .xxiiii. of June. The other of the wynter, they iudged at the eyght daye of the kalendes of January: whiche is the .xxv. of December. And here wyll I not omit to say howe in those tymes, at these foure dayes (that is to meane, in the two Solsticials and two Equinoctials) were celebrated oz dyd chaunce foure marueylous thynges in the world. For in the springe Equinoctiall, which was at the .xxv. of March, the Sonne of God was incarnate: and afterwarde bozne of the Virgin Marye in the Solsticiall of Wynter, which was at the .xxv. of December. In the Equinoctiall of Autumne, which was the .xxvii. of September, was conceaued blessed John Baptist, the cryer and pcurfour of Christ: and was bozne in the Sommer Solsticiall, that was the .xxiiii. of June. And this is the first moneth whereof S. Luke speaketh in the Gospell. Which thyng also John Chrysostome doth verysse, saying that S. John was bozne when the days began to decrease: and our Lorde when they began to increase. And it may certaynly seme woorthye to be had in memozye, that in the sayde Equinoctiall of the spring, Christ suffered, Adam was created and losse the estate of innocentie, Abell was slayne, Belchisedech offred breade & wyne, Isaac by Abraham was brought to be sacreficed, John Baptist was beheaded at Macherunta, Peter deliuered out of pryson, Saint James beheaded by Herode, The good theefe enioyed Paradyse, and the bodies of many saintes rose with Christ. And who so further desyrez more precisely to knowe the entraunce of the Sunne into Aries, and into the other principall signes, shall in the thyrde parte of this woork in the .viii. Chapiter, fynde rules which shall bypnyng hym to the knowledg

ledge therof. But to returne to our tyme, I saye that this present yeare of. 1545. the Sunne entresth into the fyfthe degree of Aries at the tenth of Marche, at foure of the clocke at after noone. And into the fyfth degree of Taurus the nyynth of Apryll. 20. houres, and seven minutes. And into Gemini the. 11. of Maye, two houres, and sixe minutes. Into Cancer, the. 11. of June. 14. houre. 44. minutes. Into Leo the. 13. of July. 3. houre 50. minutes. Into Virgo the. 13. of August. 9. houre. 56. minutes. Into Libra, the. 13. of September. 4. houre. 4. minutes. Into Scorpio, the. 13. of October. 7. houre 13. minutes. Into Sagittarie, the. 12. of Nouember, iuste at noone. Into Capricorne, the. 11. of December, 8. houre. 16. minutes. Into Aquarius, the. 9. of Ianuarie. 2. houre. 1. minute. Into Pisces, the. 8. of Februarie. 1. houre. 30. minutes after myddaye (that is to saye) from noone. 1. houre. 30. minutes. And that we maye in the yeares to come, knowe the daye, houre, and minute, in the which the sunne entereth into euery signe, we wylf folowe this order. Uppon the dayes, houres, and minutes that the sunne entereth into euerye signe this sayde yeare. 1545. we must adde for euery yere siue houres and. 49. minutes, whiche with the. 365. dayes whiche euery yeare conteyneth, shalbe the tyme in the which the sunne accomplysheth his reuolution. And because that in the yeare of the Bisertile or leape yeare, is added to Februarie one day moze to his. 28. whiche he hath ons in foure yere from. 6. to. 6. houres, yf we shall take from the computacion that whiche we haue geuen hym, turnynge one daye backwarde (as shalbe in the yeare. 1548.) and vpon that that remayneth shall returne in the yere folowynge of. 1549. to adde syue houres. 49. minutes, and as much moze euery other yeare folowynge shalbe a certayne rule for euer.

To knowe  
when the  
sunne entereth  
into euery  
of the. 12  
signes.

Leape years

And it is to note, that the degrees and minutes which we haue touched before, are properly for the citie of Cadiz. And yf we desyre to applye them for other Cities or places moze Eastwarde: then for euerye. 15.

D iiii

degrees



Variation  
of houres by  
the rapte mo-  
uyng of the  
Sunne from  
East to West

degrees that they are distant from Cadiz in longitude, we muste adde one houre. And yf for Cities or places more Westwarde, in lyke maner for euery. xv. degrees we must take away one houre, by reason of the course of the Sunne by his rapte mouyng from the East to the West. For it is certayne, that when with vs in Cadiz it is. xii. houres of the clocke: To them that are. xv. degrees Eastwarde from vs, it is one of the clocke: and to them that are from vs. xv. degrees towarde the West, it is. xi. of the clocke.

The entrance  
of the Sunne  
into the. iiii.  
principall  
signes, cause  
feth the  
chaunge of  
tyme.

Nowe that we haue rules to knowe the enterance of the Sunne into the. xii. signes, thereby may we also knowe his enterance into the foure Cardinall or principall signes: whiche are they that determine and ende the Equinotialles and Solstitialles, whereby are caused the foure tymes of the yere. And forasmuch as the generall chaunge of tyme, is by reason of the Sunne, who by his commyng neare, warmeth: by his remaynyng, dyeth: with his departure, cooleth: and by his long tarryng away, causeth moystnesse, we wyll shewe the qualities of the principall wyndes, elementes, regions, humours, and agies, in one bryefe table. And then consequently in an other, wyll we descrybe the begynnyng, myddest, and ende of the foure tymes of the yere, aswell in the monethes as in the heauenly signes.

### The Table of the qualities of the Elementes.

Qualities.	Hot & drye	Hot & moist	Cold & moist	Cold & drye
Partes of y yere	Sommer.	Sprynge.	Wynter.	Autumne.
Principal winds	East.	South.	Weste.	North.
Elementes.	Fire.	Ayre.	Water.	Earth.
Regions.	East.	South.	West.	North.
4. Humours.	Choler.	Bloud.	Fleame.	Melancholy
4. Agies.	Youth.	Mans state.	Aged.	Age.

The

**The Table of the foure tymes of  
the yeare.**

Tymes.	Begynnyng.	Myddest.	Ende
Springe.	Marche. Aries	Apryl. Taurus	May. Gemini
Sommer	June. Cancer	July. Leo	August. Virg.
Autumne	Septemb. Libra	Octob. Scorpio	Novemb. Sagit
Wynter.	Decēber. Capricor.	Januar. Aquar.	Febru. Pisces

**The. v Chapter of the Moone,**

and of her motions and properties.



**M** the Chapters past of this seconde part, we haue entreated of the Sunne and of his motions and effectes, as the moste noble and principall luminarie. In this present Chapter we wyll intreate of the Moone which is the seconde luminarie, although in the order of the heauens she is the fyrste, and neareste vnto vs of all other planettes or starres. The Moone therfore is a rounde body, of heauenly substance, solide and darke in respecte of the Sunne, hauyng no proper lyght of her owne, but is apte to receaue lyght. She is moued from the West into the East according to the order of the signes, euery daye. 13. degrees, lyttle more or lesse, and sumwhat more then. 10. minutes, by the proper motion of the heauē or sphere vpon the Axis & poles of the Zodiac. I said more or lesse, because y<sup>e</sup> ouer and besyde the mouing of her deferent or circle which is moued euery day the aforesaid. 13. degrees & 10. minutes, almost 11. she hath an Epicycle where y<sup>e</sup> Moone is tyed. At the motion wherof, sumtymes she is moued more swyftly, and sumtymes more slowly. Neuerthelesse, according to her halfe motion, she maketh her course in. 27. dayes and almost. 8. houres. And hauyng no light of her owne she is lyghtened of the Sunne, as manifestly appeareth hereby, that beyng in coniunction with the Sunne, or neare vnto hym, we see her not lyghtened: because the lyght whiche she then receaueth, is onely by her vppermost or hyghest part wherby she directly beholdeth the Sunne

The Sunne and moone are the principall luminaries.

The Epicycle of the moone.

The coniunction of the moone with the sunne.

The moone receiueth her lyght of the sunne.



The aspects  
of the moon  
to the sunne.

The increas-  
ing and op-  
position of  
the moone.

The bygge-  
nes of the  
moone.

The moone  
is neareste  
vnto the  
earth.

Sunne, forasmuch as he is in the fourth heauen and the  
in the fyrst. And departyng from the Sunne by her pro-  
per mouyng, the Sunne remaineth on the West part.  
Then towarde that part we begyn to see a lyttle of the  
part of the Moone lyghtened, and so more and more by  
little and little as she departeth further from the sunne.  
And at this tyme she hath her hoznes or corners toward  
the East, because the Sunne is in the West. Duryng  
this tyme also, she is sayde to increase, or that she goeth  
increasynge vnto the opposition which we see by the part  
of her, which the Sunne directly beholdeth. And so do  
we see her altogether lyghtened, and call it the full  
Moone. Then passing from the opposition, she commeth  
nearer the Sunne by lyttle and lyttle, beyng darkened  
and hyd from vs, and lyghtened onely by her hygheste  
part. And this tyme is called the decreasynge or wane of  
the Moone. Then also hath she her hoznes towarde the  
West, because the Sunne is in the East: and this vn-  
tyll she turne agayne in coniunction with the Sunne, &  
that we see her not lyghtened at all.

The Moone is lesse then the starres or other planets,  
except Mercury, and lesse then the earth. And yf anye  
shall affirme the contrary, saying that it is wrytten in  
the fyrst of Genesis, that God made two great lyghtes:  
the greateste to geue lyght to the daye, and the lesse to  
lyghten the nyght (as Dauid also affirmeth:) To this I  
aunswere, that the Moone being nearest vnto the earth  
appeareth vnto vs greater then she shuld do, yf she were  
further distaunt from vs. And although she be great of  
lyght (receaued as we haue sayde) and bygge of bodye,  
yet is she not great in respecte of the other starres. And  
therfore the wordes of the Genesis aforesayde, maye be  
vnderstode to be spoken in such maner and phrase as ho-  
ly scripture often vseth to humble and applye it selfe to  
the weakenes of our vnderstandynge, and grossenes of  
our senses.

**C**The .vi. Chapter of the coniunctions  
and oppositions of the Sunne & the Moone.

The.



**T**he Sunne and the Moone are moued vnder the Zodiac with diuers motions. *The motion of the moone.* The Moone with a swifter motion then the Sunne soloweth hym, ouertaketh hym, and goeth before hym, vntyll she place her selfe in Diameter with hym. And when

she hath thus ouertaken hym, so that they are both in one selfe same degree of the Zodiac: then is the coniunction. *The coniunction.* Then departynge from hym, and beyng in

equall degrees of the signes opposite accordynge to the Diameter, is the opposition. To knowe the tymes of these coniunctions and oppositions, is verpe profitable & necessary for Maryners. *The opposition.* These tymes may be knowe

en in two maners. One waye by the Ephimerides or Almanackes, or other tables, or Lunary instrumentes. *To knowe the tymes of oppositions and coniunctions.* And by these meanes is knowen precisely the day, houre and minute of the coniunction and opposition. It maye lyke wyse be knowen by the rules of computacio, which are the rules that are knowen by memozye, although not precisely as by the bookes aforesayde. And here is to be vnderstode, that from one coniunction to another, accordyng to the halfe mounynges of the Sunne and the Moone, there passeth. 29. dayes. 12. houres, and. 44. minutes. And consequently from coniunction to opposition, and from opposition to coniunction, the halfe therof, which is. 14. dayes. 18. houres, and. 22. minutes. To knowe these coniunctions by rules of computacion, is presupposed to knowe the golden number: and by it, the concurrent or Epacte.

The golden number, is the number of. 19. yeares. In which tyme, the coniunctions of the Sunne & the Moone make all theyr bareities in the tymes of euer y pere. So that if the coniunction were the. 12. day of Marche in this yeare of. 1545. from this yeare in. 19. yeares folowynge, which shalbe in the yere of. 1564. the coniunction shal re-  
turne to be at the. 12. day of March. It was fyrst called the golden number by the Egyptians, who first found the vse therof & sent it to Rome wyttē in golde letters. To find this nūber, it is nedeful to know his votes, which is this

In



The rootes  
of the golde  
number.

In the yeare that Christ our Lorde and redeemer was borne (wherby we make this accompt) the golden number was the number of one, which was the yeare of the roote or begynnynge, and the fyrste yeare of the byrth of Christ, was two of the golde number. So that ioynng to the yeares of our Lorde one of the roote or beginning and from all take away the .19. then the reste shalbe the golden number. And yf you desyre to make computation by a nearer roote, take for the roote, the yeare of .1500. when .19. was the golden number: and in the yeare of 1501. dyd begyn one of the golden number, and so consequently euer takynge away the .19.

This present yeare of .1545. we haue .7. of the golden number. And in the yeare of .1546. we shal haue .8. &c.

The concurrent.

The golden number being knowne, it is necessary for this computation of the Moone to knowe the concurrent. The concurrent of euery yeare, is the number of the dayes passed of the coniunction of the Moone at the begynnynge of Marche. And these grow of the difference of the Solar yeare to the Lunar: as the Lunar yeare hath .354. dayes, and the Solar yeare .365. so hauynge euery yeare .11. dayes of difference, which are added euery yeare vntyll they come to the number of .30. and passing .30. those that do passe are of the concurrent.

The Solar  
and Lunar  
yeares.

354. 365.

11. add.

11

To fynde  
the number  
of the con-  
current.

The number of the concurrent of euery yeare, is founde in this maner.

And the better to beare it in memory, you must imagin three places: and these commonlye are assigned on the thumbe. As the fyrste place at the roote of the thumbe, the seconde in the myddle ioynt therof, and the thyrde & last, in the toppe of the thumbe. Then in the fyrst place put .10. in the seconde .20. and in the thyrde .30. Then by the order of these places shalbe coumpted the golden number: As one in the fyrst place, two in the seconde, and three in the thyrde: returnynge foure to the fyrste place, &c. vntyll the golden number of that yeare for the which the concurrent is sought. And the number of that place where the golden number endeth, must be ioyned with the number of the golden number: and that doth amount

amounte thereof, shall bee the concurrent, so that it passe not. 30. But if it passe. 30. then that that is moze then. 30. is the concurrent of that yeare.

And here is to be noted, that the yeares for this computation of the Moone, begyn at the first day of Marche, and laste vntill the last daie of February. So that this present yeare of. 1545. by computation of the golden number, we haue seuen: whiche accompted by the sayde places, endeth in the fyrst, whiche is. 10. whiche also toynd with the golden number of seuen, make. 17. and so muche is the concurrent of this present yeare.

Epact.

Likewyse this number of Epact or concurrent is founde in multiplying the golden number by. 11. and taking out the. 30. then that resteth, is of the Epacte.

The concurrent being thus knowen, then to knowe the dayes of the Moone, it is necessary to knowe three numbers. The fyrst is the concurrent. The seconde, the number of the moneth in whiche you are, beginnyng at Marche. The thyrde, the dayes past of the same moneth. And toyning these thre numbers, if they come not to. 30. so many dayes old is the Moone. And if they be. 30. it is the coniunction. And if they passe. 30. they also that passe are the age of the Moone.

To knowe the dayes of age of the moone.

This is vnderstode in the monethes that haue. 31. dayes. For in them that haue only. 30. dayes, the coniunction is at the. 29. daye. And they that passe of. 29. are the age of the Moone. As for example: The fyrste daye of August, of the concurrent. 17: Of monethes from March 6. and of dayes of the moneth. 1. make. 24. and so muche is the age of the Moone.

An other example. The tenth of September, of concurrent. 17. of monethes seuen, of dayes tenne, whiche are in all. 34. And because that September hath onely 30. dayes, we must take away. 29. of the. 34. and so resteth fyue dayes whiche are the age of the Moone. And in like maner shall we geue to February nyne & twenty dayes of the Moone.

To knowe the dayes of the coniunction.

It foloweth, that the dayes of the Moone beyng knowne, then vntrekenyng or disrekenyng backwarde,

we



we shall knowe the daye when the Coniunction was :  
As for example. The. rr. of July, the Moone hath. xii.  
dayes taken from the. rr. Remayneth. viii. Then the  
eyght day was the coniunction.

The daye of the coniunction is lyke wyse knowen by  
ioynnyng the monethes (begynnyng in Marche) with the  
concurrent. And yf they come not to. 30. then at so ma-  
ny dayes of that moneth as lacketh of. 30. shalbe the con-  
iunction. Example.

In August. 6. of the monethes, and. 17. of the concu-  
rent, are. 23. whiche of. 30. lacketh. 7. Then at the se-  
uenth daye was the coniunction. And yf they passe. 30.  
Then takyng them that passe, of the dayes which hadde  
the moneth next befoze : in them that remayne was the  
coniunction. Lyke as the Moone of September of the  
yeare. 1546. we shall count the concurrent. 28. of mo-  
nethes. 7. which are. 35. Then taking away the. 5. from  
30. and one which August hath, remaineth. 29. and so the  
26. of August, of the yeare to come of. 1546. the Moone  
shall make coniunction.

**C** The. vii. Chapter of the declaration  
and vse of an Instrument, by the which  
is founde the place and declination  
of the Sunne, with the  
dayes and place of  
the Moone.



In the seconde and thyrde Chapter I haue  
geuen rules to knowe the true place of the  
Sunne and his declination. In this Cha-  
piter I wyl describe an Instrument where-  
by may be knowen the declination & place  
of the Sunne. And knowyng by the Cha-  
piter past, the dayes of the Moone, shall also be knowen  
her place in the Zodiac, and howe muche of her is lygh-  
tened, and what aspect she hath with the Sunne. This  
Instrument is in square fourme, and hath by the sydes  
23. degrees and a halfe : Of the whiche the. 23. & a halfe  
that

To knowe  
the place of  
the Moone in  
the zodiac,  
and what as-  
pectes she  
hath with  
the Sunne.

that descende from the myddest do wnewarde, is the declination of the South signes: and the other from the myddeste bpwarde, are the declinations of the North signes. Within this quadrature is described a circle, by the circumference wherof are the .xii. signes and they 2 degrees, ioyned to the circumference. And further within is the number of them, and then they 2 names. Yet further within this, is another circle, where are the .12. monethes, with they 2 numbers and dayes.

The description of the instrument.

Then to the center of this circle are annered two rundels: wherof the greatesse and lowesse is called the rundell of the Sunne. This hath an Index or shewer, in which is paynted y Sunne, & in the circumference of it are the dayes of the Moone. In the other circle, in the circumference thereof, is a rounde hole, representyng the Moone: Directly from the which, is an other Index commyng forth of the circumference of this rundell, in which are all the lines of the aspectes which the Moone maketh with the Sunne.

Hauyng described the Instrument, let vs declare the vse therof: which is this.

The vse of the instrument to find the true place of the sunne.

Fyrst to fynde the true place of the Sunne, we must put the Index of the rundell of the Sunne, vpon the daye of the moneth in which we are or desyre to knowe. Then in the circle of the signes, it shal shewe the signe and degree in the which it is. And in lyke maner, restyng styll vpon the degree, loking in the paralels that touch in the circumference, & proceeding by that that toucheth in the degree of the Sunne, which the Index doth note toward the syde of the Instrument: there shal we fynde the number of the degrees of the declination whiche the Sunne hath at that day.

To fynde the place of the Moone, we muste holde the Index of the rundell of the Sunne, fast vpon the daye of the moneth in the whiche we desyre to knowe the place of the Moone. And accoumptynge in the rundell of the Sunne, the dayes that haue passed from the daye of the coniunction (as I haue sayd in the Chapter before) and where endeth that number of the dayes, yf there

To fynde the place of the moone.

we



The 2. part.

We apply the Index of the Moone, it shall shewe in the circle of the signes, the place where she is. And so shall she appeare lightened or darkened more or lesse as in heauen. In lyke maner, consyderinge the place of the Sunne and the Moone, shalbe seene what aspecte they haue, by the lynnes that traaverse the superficial of the Lunar circle or circle of the Moone.



The aspectes which the planettes haue one to another, or whereby they beholde one another, are fyue.

fyue aspectes of the planettes.  
Comunat.

Coniunction, is when two planettes be vnder one selfe same degree and minute in the Zodiac, whose character is this.  $\circ$

Opposition.

Opposition, is when betwene the place of the planettes is halfe a circle, which are. 180. degrees, and is thus figured.  $\circ$

Trinall aspecte, is when betwene the planettes shal be foure signes, which are. 120. degrees, and is figured thus.  $\triangle$

Trinall.

Quadruple aspecte, is when one planette is distaunte from another by three signes, whiche are. 90. degrees, whose character is this.  $\square$

Quadruple.

Sextile aspecte, is when two signes are betwene the which are. 60. degrees, and is marked thus.  $\times$

Sextile.

And yf by memozy you desyre to knowe the true place of the Sunne, without respecte of the minutes (whiche may sufficiently be done with the Astrolabie) beare in memozy these numbers. 10. 9. 10. 10. 11. 12. 13. 14. 13. 14. 13. 12.

To knowe the place of the moone by the rule of memozy.

Of the which, the fyrst serueth for January: the second for February with theyr signes: and so of the rest.

Then to knowe in what degree the Sunne is, you shall take away the dayes that are applyed to euery moneth, accordyng to the sayde numbers of the dayes for the which you desyre to knowe the true place of the Sunne. And in them that remayne, in so manye degrees is the Sunne of the signe into the whiche it entereth that moneth. And yf the dayes past of the moneth, shalbe lesse then the dayes applyed to the same moneth: you shall toyne. 30. with those dayes past of the moneth, and of the summe that amounteth, you shall take awaye the dayes applyed to the sayde moneth: and the rest shalbe the degrees in whiche the Sunne shalbe of the signe of the moneth past: as for example.

To knowe in what degree the sunne is.



**E**xample.

January.	10.	♊	The. 22. of October, ta
February.	9.	X	king awaye. 14. that were
Marche.	10.	V	applyed, remayne. 8. de
Apryll.	10.	♊	grees of Scorpio, wher the
Maye.	11.	♊	Sunne is. The. 6. of Decē
June.	12.	♊	ber, that that is lesse then
July.	13.	♊	12. which are applied to it,
August.	14.	♊	ys we ioyne the. 6. with. 30
September.	13.	♊	they make. 36. and from
October.	14.	m	them we take away the. 12
November.	13.	♊	rest. 24. So in 24. degrees
December.	12.	♊	is the Sunne, of the signe

of the moneth before, which is Sagittary.

**T**he. viii. Chapter of the Eclipses

of the Moone and the Sunne.



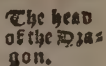
The Eclipses of the Sunne & of the Moone is a thing that causeth great feare and admiration amonge the common and ignorant people. And to them that vnderstand the cause therof, nothing at al. And therefore haue I thought good to declare the effectes therof.

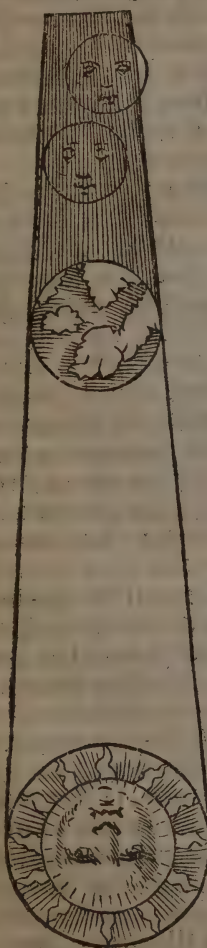
The eclipse  
of the moone

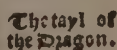
The mo-  
ving of the  
Sunne in  
the Ecliptik

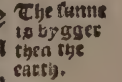
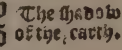
The Eclipse of the Moone, is the interposition of beyng of the earth betwene her and the Sunne. And whereas the Moone hath no proper lyght of her owne, and the earth beyng darke and not transparent, maketh his shadowe on the parte opposite to the Sunne. The Moone by her proper motion doth passe by this shadow and is Eclipsed or darkened eyther in the whole or in part, accordyng to the portion of her that passeth by the shadowe. Moreover (as we haue sayde) that onelye the Sunne is moued by the line Ecliptyke, & the earth being in the Center of the world, the point or pyncke of the shadowe shalbe vnder the Ecliptik. The Moone at somtymes declineth to one part of the Ecliptyke, & at other tymes to the other, because her Eccentricke so moueth.

The

The greatest declination or latitude of her Eccentricke is .5. degrees, and cutteth in two partes the Eccentrick of the Eclipticke. The one where it traueserseth to the Eclipticke towarde the North part, which they call the head of the Dragon, and is marked thus.  *The head of the Dragon.*



The other wherby she passeth to the South part, which they call the tayle of the Dragon, & is marked thus.  *The tayl of the Dragon.* And the Sunne mouyng by his proper motion, and commyng to the head, then shall the shadow of the earth be in the tayle, because it is the poynte opposite. And yf then the Moone come thither, of her proper motion she passeth by the shadow: and lackyng lyght of the Sunne, is in the Eclipse. And if the Sunne come to the tayle, the shadowe is in the head. And then lyke wyse shall the Moone be Eclipsed yf she passe by the head.

It is to vnderstande that the Sunne is muche bygger then the earth. And by perspective, the shadow of the earth in how much the further it parteth fro  *The sunne is bygger then the earth.* it, becommeth sharper & sharper vntyll it come to a poynt: So that the shadowe of the whole earth, is pyramidallye sharpe. And as the Moone is lesse then the earth, yet (although his shadow goeth sharpenyng) it suffiseth to Eclipsie the Moone yf she passe by the myddest thereof.  *The shadow of the earth.*



The eclipse  
of the sunne

The Eclipse of the Sunne, is the interposition of the Moone betwene vs and the Sunne. As yf the Sunne be in the fourth heauen, and the Moone in the first, she being a darke bodye, and by her proper motion ouertake the Sunne: then puttynge her selfe betwene hym and vs, she couereth hym in part or in the whole: and this is the Eclipse of the Sunne. As the Sunne also goeth euer vnder the Ecliptike at the tyme that he commeth to the head or tayle of the Dragon, yf then the Moone make coniunction with hym, shalbe the Eclipse of the Sunne, sozasmuch as they are both vnder the Ecliptike.

The eclipse  
of the sunne  
is not vni-  
uersall.

The  
sunne is ec-  
clipsed in  
the whole  
or in part.

The Eclipse of the Sunne can not be vniuersall in the whole earth. I saye vnto all them that maye see the Sunne at the tyme of the Eclipse, as is the Eclipse of the Moone vniuersall. For yf the Moone haue one parte Eclipsed, all that maye see her, shall see her Eclipsed: But the Sunne some may see all wholly eclipsed, and other in parte, or other also not at all eclipsed: and this all at one selfe same tyme. The cause wherof, is the diuersitie of the aspecte, whiche is to see the Moone in the Zodiac out of her place. As yf the Sunne and Moone shoulde make coniunction in the begynnyng of Aries & in the head of the Dragon: they that then shoulde be in the Equinoctiall vnder the Sunne and the Moone, or that the Sunne and the Moone shoulde be in theyr Zenith, they shoulde see the Moone hyde all the Sunne. And they that shoulde be in the North climates, shoulde see that the Moone hydeth or darkeneth only the South parte of the Sunne, and not all. Agayne, they on the South parte, shoulde see the Moone hyde the North part of the Sunne, and not all. And yf at the time of the coniunction, she haue a lyttle passed the head of the Dragon, or lacke a lyttle to come to the tayle, so that shee be in the North latitude: they that then shoulde be in the North Climates, shoulde see the Moone eclipse all the Sunne: and they of the Equinoctiall shoulde see onelye the North parte of the Sunne eclipsed, and they of the South shoulde see hym nothyng at all eclipsed. So that  
although

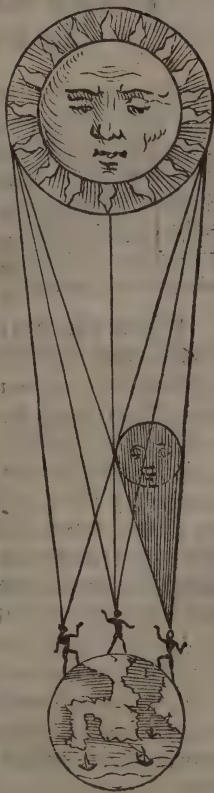
although the Eclipse of the Sunne shalbe totall or particular, it can not be vniuersall in the whole earth.

And note, that for the quantitie of these Eclipses, the Astronomers deuide into. xii. equall partes, aswell the Diameter of the Sunne as of the Moone. And these partes they call fingers, punctes or prickes. And according to the punctes of the Diameter of the Moone which couereth the shadowe of the earth, or the partes of the Diameter of the Sunne whiche couereth the Moone, so many fingers or punctes shalbe sayd to be Eclipsed. As yf. 6. the halfe, yf. 3. a quarter, yf. 4. a terce or thirde part, yf. 9. three quarters, yf. 8. two terces.

It is also to be noted, that although the Sunne be bigger then the Moone, yet at some tyme the Moone seemeth greater then the Sunne. And this shalbe when the Sunne is in the Auge of the Eccentricke, and the Moone in the opposite of the Auge of the Epicycle. And when it so appeareth, he may be all Eclipsed. Sometymes also the Moone seemeth lesse. This is when the Sunne is in the opposite of the Auge of the Eccentricke. And the moone in the Auge of the Epicycle. Then although we should see the center of the Moone in the center of the Sunne, she can not hyde hym all wholly, because the Sunne shall appeare greater.

Of this that we haue sayde, it foloweth that all the Eclipses of the Sunne, muste of necessitie be in the coniunction. And the Eclipses of the Moone, in the opposition:

C iii



To knowe  
the quanti-  
tie of the E-  
clipses.

Why the  
Moone see-  
meth some-  
time bigger  
& sometime  
lesse then the  
Sunne.

The Sunne  
is eclipsed  
in coniunc-  
tion, and the  
Moone in  
opposition.

Eclipse



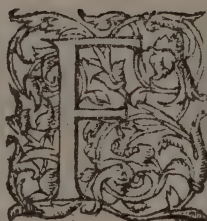
The eclipse  
of the sunne  
in the death  
of Christ.

Howe to see  
the eclipses.

Eclipse of the Sunne in the death of Christe our redeemer, was not naturall, but miraculous: forasmuch as then was xv. dayes of the moone, at whiche tyme the moone is at the full, and farre distant from the Sunne, and coulde not Eclipse hym. In lyke maner is to be noted, that to see the Eclipses, they of the Sunne must be in the daye, and they of the Moone in the nyght. And whether the coniunction be in the nyght, or the opposition in the day, the Astronomers make none accompt.

## The. ix. Chapter of Tyme, and of the definitions therof.

All mouinge  
is in tyme.



As muche as hitherto we haue entreated of the mouinges of the Sunne and of the Moone: and howe all mouinge is in tyme (for that nothyng maye be moued in an instant or out of tyme) It shalbe conuenient nowe to declare what thyng Tyme is, and in to what partes it is deuied.

What is  
tyme.

Howe tyme  
is cause of  
generation  
& corruptio.

The begyn-  
nyng & en-  
dyng of  
tyme.

The place  
of tyme.

Tyme (as sayth the Philosopher) is a measure of mouyng accordyng to first and last, or before and after. Although by accident (as Armandus hath subtylly defined) Tyme may be a measure of rest or quietnesse: as measures of habites are measures of priuations. And Tyme may be a measure of the mouyng of the first mouable called Primum mobile, and cause of generatio thereby, and of corruption by accident. Tyme hath the bymittes that hath the worlde. And as the worlde, so is it caused of the mouyng of the heauens: and beganne whan God created the heauens, and shall ende when the worlde shall haue an ende, as the holie Scooles of the Diuines teache vs. It is assigned to be within the heauens: forasmuch as without them, is neyther time nor any naturall place. All the tyme sence God created the worlde, vntyll it shall haue an ende, is called Seculū (that is) a worlde, or an age of Tyme. Albeit this word  
Seculū

Seculum in an other sence, may be extended further then the durabilitie or continuance of the worlde. And this in holpe Scripture is called Seculum seculi: that is, the worlde of the worlde: or seculum seculorum, whiche is as much to meane, as the worlde & worlde to come: which signifieth eternitie, or euerlastyng worlde without end. Lyke wyse also seculum is taken for the space of a hundredeth yeares: whereby in olde tyme certayne playes were called seculares, because they were celebrated from a hundredeth to a hundredeth yeares. The Pope Paule, the thyrde of that name, commaunded them to be celebrated in Rome, in the yeare of. 1536. which was the yeare in the whiche the seculum ended, and beganne a newe seculum.

And as in Tyme are dyuers mownges, so hath it dyuers measures: whereof some are greater and other lesse. The greatest measure of Tyme, is a revolution of the heauens which is slowly moued. And the princypall or chiefe of these, is that that the Sunne maketh: which we call a yeare. The lesse measure, is the mouing of the fyrste moueable, whiche moueth moste swyftely: and this measure we call a day. And forasmuch as there is variation in the greatest measures, we wyll in the Chapter folowynge entreate of the yeare and of the diuersitie therof.

Diuerse mownges and measures of tyme.

## The. x. Chapter, of the yeare,

and of the dyuers begynnynge and  
rekenynge, or comptacion  
had therof in old tyme.



Here are three differences of the yeare: as the great yeare (called Annus Magnus) the Solar yeare, and the Lunar yeare. The great yeare, is the space of tyme in the which all the planets returne to the place where they had ben sometyme befoze. As yf they all had ben in the beginning of Aries, & had begunne theyr course from thence, and shoulde agayne all returne thither: then shoulde be the great yeare.

Three differences of yeares.

The great yeare.



The revolu-  
tion of the  
eight sphere

The solar  
yeare.

Howe the  
Egyptians  
painted the  
yeare

The quan-  
tite of the  
yeare

The yere of  
the Hebrewes  
The grekes

Julius Ce-  
sar

Leape yere

Days of the  
yeare.

By the description of other, the great yeare is when the  
eighth sphere ioyntly with all the Angles, make one per-  
fecte reuolution at the mouyng of the ninth sphere. And  
this shalbe in the space of. xlii. thousande yeares.

The Solar yeare, is a reuolution of the Sunne, ca-  
rried by the proper mouyng of his heauen vpon the Axis  
and Poles of the Zodiac, endyng where it began, and  
returning an other yeare by the selfe same course, as the  
Poet Virgill affirmeth, saying.

Atq; in se sua per vestigia voluitur annus.  
That is to saye. The yeare turneth agayne to hym  
selfe by his owne steppes.

The Egyptians lackyng the vse of letters, & hauyng  
the same consideration, paynted the yeare lyke vnto an  
Adder, bytyng her owne taylor. And hereof was a ryng  
called Annulus, as it were Annus, (that is a yeare) be-  
cause a ring turneth rounde in it selfe as doth the yeare.

Of the quantite of this yeare, were dyuers opinions &  
computacions among them of auncient tyme. The Ara-  
bians and Persians accompted it regularly by. xii. moones  
which are. 354. dayes. Romulus gaue to his yeare. r. mo-  
nethes, because that tyme suffised to a woman to bring  
foorth her byrth: and also for that during so much time,  
it was not lawfull for a wydow to marry after the death  
of her husbände. Numa Pompilius added two monethes,  
to make it by twelue monethes in. 350. dayes, whiche  
was the most auncient yeare of the Hebrewes: accordyng  
to the which they accompt at this day. The Grekes and  
Egyptians, consideryng the course of the Sunne, made  
the yeare of. 365. dayes. Then by the commaundement  
of Iulius Caesar (whose order we nowe obserue) were ad-  
ded. 6. houres, to thende to make equall this number of  
dayes with the course of the Sunne. And hereof the bi-  
sertile or leape yeare had his begynnyng, from foure to  
foure yeares. But to say the truth, they erred: The  
one by somewhat to muche, and the other by somewhat  
to lyttle.

The yeare conteyneth. 365. dayes. 5. houres, and  
49. minutes.

Lyke

Lykewylfe at the fyrste the yere had dyuers begyn, <sup>Beginnyng</sup> <sup>of the yere,</sup>  
 nynges. Numa Pompilius beganne it from the Wynter  
 Solstitiall, because that then the Sunne beginneth to rise  
 towarde vs, as Ouide affirmeth in these verses. <sup>Order.</sup>

Bruma noui prima est, veterisq; nouissima Solis :  
 Principium capiunt Phebus & annus idem.

Which may thus be Englyshed.

Brume is the fyrst of the newe yere,  
 And last day of the olde :  
 The Sunne and yere begynne at once,  
 As Ouide hath vs tolde.

Bruma, is  
 the daye of  
 the Sunne  
 in wynter,  
 the wynter  
 solstitiall &  
 the first daye  
 of the yere

Romulus began it in Marche, at the Equinoctiall of the  
 sprynge : because that then all thynges reuiue and flo-  
 rysh. And by the opinion of the Diuines, it seemeth  
 good reason to begyn the yere at Marche, because the  
 world was created the. 25. of the kalendes of Apryll,  
 whiche is the. 18. of the moneth aforesayde. Lykewylfe  
 God speakynge of this moneth to the people of Israell,  
 sayde vnto them : This shalbe the fyrst of the monethes  
 of the yere. The Arabians begynne from the sommer  
 Solstitiall : whose opinion is, that the Sunne was  
 made in the signe of Leo. Other begynne the yere in  
 September, about the Equinoctiall of Autumne, as do  
 the Jewes, resting in the auctoritie of Genesis where  
 is wyrtten thus : Lette the earth bryng forth greene  
 hearbes to haue fruite agreable to theyr kynde. &c. And  
 because Autumne is a fruitfull tyme, they began from  
 thence to accompt theyr yere. The Grekes, Persians,  
 and Egyptians accompted it from October. The Chri-  
 stians, some from the Incarnation of Chyzt : other fro  
 his byrth, and other from the fyrst day of January.

The creatio  
 of the world  
 Exod. xii.

where the  
 Christians  
 begynne the  
 yere.

In lyke maner is great diuersitie in begynnyng the  
 number of yeres, which we call Era, (that is) the date.  
 The Grekes beganne theyr date from the death of  
 greate Alexander. The Egyptians from the death of  
 Phabu.

Diuersitie  
 in the num-  
 ber of yeres  
 of the date.



**Machomet.**

**The date of  
the Christi-  
ans.**

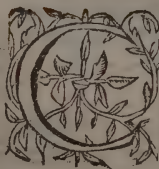
Nabuchodonosor. The Persians, from Geldargir. The  
Arabians or Moores, fro the preaching of Machomet,  
who was after the byrth of Chryst. 626. yeares. Other  
also from the Romane Emperours. The Christians be-  
gan the accompt of our Sauour Iesu Chryst. 500. yer-  
es after his byrth, as writeth Cardinall Cusanus. And here  
it shall not be from my purpose to shewe howe iustelye  
and ryghtfully was commaunded by Don John kyng of  
Spayne, the fyrste of that name, that in the courtes and  
Parliamentes which he held in segouia, in the yeare of  
1383. leauyng the dates that they had begonne from the  
Emperour Octauian, for tributes & other paymentes  
specified in wrytynges and priuileges: they shoulde no  
more put the date of the Emperour, forasmuche as the  
day in the which the Sunne of Godde became man, and  
was borne of the blessed virgin, was so excellent a thing  
and mooste woorthy to be hadde in memozy. So that in  
Spayne sence that tyme in all common wrytynges, the  
date is made from the Patiuitie of our Lorde, begyn-  
nyng there the fyrst day of the yeare: and commonly the  
fyrst day of January. Some Astronomers begynne it  
the fyrst of Marche.

We haue in this Chapiter entreated of the greate  
yeare, and of the Solar yeare, with his quantitie, be-  
gynnyng, and date. In the Chapiter folowynge we will  
entreate of the Lunar yeare, which we call a moneth.

## The. xi. Chapiter of the Moneth, and of his differences.

**The Lunar  
yeare or mo-  
neth.**

**Reuolution  
of the mone.**



Onsyderynge the Moneth absolutely with-  
out hauyng respect to the Solar yeare, it  
may be called a yeare, accoording to the de-  
uision we haue made in the Chapiter of the  
yeare. For it is a reuolution of the hea-  
uen of the Moone, which moueth slowly  
in comparison to the fyrste heauen. And if  
we

We consider the moneth as part of the yeare, then is the name of a Moneth moze proper vnto it. For this worde Mens Mensis in Latin, is deriued of Mensura, which signifieth measure. And so, the moneth and yeare referred to tyme, all may be called moneth: Forasmuch as all is the measure of tyme, as we haue touched in the sayde Chapter of the yeare.

The moneth is to be considered in two maners: eyther as it is parte of the Solar yeare, or is caused by the course of the Moone. The moneth that is parte of the Solar yeare, is that which at this day we vse. And into xii. of these monethes is the yeare deuyded: As Ianuary, February, Marche, Apryll, May, June, July, August, September, October, Nouember, December. They are not all of equall dayes. Apryll, June, September, and Nouember, haue .30. dayes: All the other haue .31. except February, which hath .28. and when the bisfertile or leape is, it hath .29. The names & numbers of these monethes were assigned at the wyll and pleasure of men: And the cause why they haue remayned so long tyme, is the auctoritie of the Emperours, that ordeyned them for the common people, who accepted them by the Roman Church which admitted the vse of them.

The Lunar moneth hath two considerations. The one is the tyme whiche the Moone tarpyeth from that she cometh forth from one puncte of the Zodiac, vntyll she retorne thither by her proper mouyng. And this is called the moneth of peragracion: In which reuolution she spendeth .27. dayes and almoste .8. houres. The other consideration, is hauyng respecte to the tyme which the Moone tarpyeth from that she is in coniunction with the Sunne, vntyll an other coniunction. And this is called the moneth of consecucion, and is moze then the moneth of peragracion by .2. dayes .4. houres .44. minutes. For the Sunne and the Moone beyng in coniunction vnder one puncte of the Zodiac, and mouyng both by theyr proper mouynges towarde the East, as the mouyng of the Moone is swifter then the mouyng of the Sunne: she leaueth hym behynde.

And

The deuision of the yeare into xii. monethes

The Lunar moneth.

The moneth of peragracion.

The moneth of consecucion

The mouyng of the Sunne and Moone in coniunctiō.



And when she hath ended her moneth of peragratiō, she returneth to the poynte from whence she departed: And not finding the sunne there (because in the meane tyme the Sunne of his proper motion hath gone almost 27. degrees) the Moone passeth from this poynt: and in the sayde. 2. dayes. 4. houres. 44. minutes, ouerta- lieth the Sunne. And so commonly hath this moneth of consecution. 29. dayes. 12. houres and. 44. minutes. So that whatsoeuer is sayde of the Lunar moneth, is to be vnderstode of this moneth of consecution, whiche all they vse that accompt by moones: as do the Hebꝛues, Arabians and Persians.

To knowe  
the tydes by  
the aspectes  
of the moone.

The illumi-  
nation or  
chaunge of  
the moone.

Interlunium, is the  
space of  
tyme in the  
which ney-  
ther the  
olde moone  
doth appere  
nor the new  
moone is  
sene.

The Maryners ought not to neglecte this computacion because it is conuenient for them to knowe the tydes and other effectes caused by the aspectes of the Sunne and the Moone. For theyr aspectes do corresponde to the partes of this moneth, as the coniunction to the begyn- nyng, the opposition to the myddeste, and the quartyle aspede to the quarter, and so of the other. Lyke wyse in this moneth, is considered the illuminatiō of the moone and the dayes that the lyght fayleth her: so that neither by day nor by nyght we may see her for being burnt vnder the beames of the Sunne. The tyme that she is so, is called Interlunium, (that is) the chaunge or hydyng, which is sometyme more, and sometyme lesse. When the coniunction shalbe from the begynnyng of Capri- corne vntyll thende of Gemini, and the Moone hath North latitude, and her mouyng swyfte: then shall the newe Moone soone be sene, and so shall the Interlunium be but lyttle. And when the coniunction shalbe from the begynnyng of Cancer vntyll the ende of Sagittarius, and the Moone hath South latitude, and her mouyng slowe: the longer wyll it be or the newe Moone shewe her selfe to vs. And certen of these causes concurringe and not all, so shall the Interlunium be in a meane betwene both.

## The.xii. Chapiter, of the weeke.



The weeke is a time of seven dayes, the begynnynge wherof is Sundaye. And so dyd the Iewes count theyr fyrst day sayinge, Prima sabati, Secunda sabati, (that is) the fyrst of the Sabbath, the seconde of the Sabbath, &c. to the syxt of the Sabbath, and then the Sabbath. The Romans that called the planettes Gods, forasmuche as the Sunne was pryncipall among them, called theyr fyrst daye, the daye of the Sunne, the seconde of the Moone, the thyrde of Mars, the fourth of Mercury, the fyfth of Jupiter, the syxth of Venus, and the seventh of Saturne. The Chrystyans solemnysynge the Sunday, began theyr accompt from it: As on such a day our Lorde was borne, on such a day he rose, and on such a daye he sent the holy ghosse vpon his Apostles, &c. They also accompt the dayes of the weeke for Ferias.

The weeke of the Iues.

The Romans.

The Chryistians.

Ferias, signifie vacant dayes, or somtyme holy or festiual dayes.

## The.xiii. Chapiter, of the day and of the nyght.



The day is of two sortes: As the naturall daye, and the artificiall daye. The naturall daye, is the tyme whiche the Sunne pprolongeth or tarteth from the mouyng of the fyrste moueable from that he is in the South vntyll the West, & vnder the earth to the East, turnyng agayne to the South or Meridian. And in this tyme hath the Equinodial geuen one whole turne: and moze such parte of it as correspondeth to the proper mouyng of the Sunne. Or otherwyle, the naturall day is a circle described with the center of the Sunne at the mouyng of the fyrst moueable. The Romanes began this naturall daye from mydnyght, and ended it in the mydnyght folowynge. And so do we accompte it for fastyng

The naturall day.

The begynnynge of the naturall day



fastyng dayes : & from euening to euening, in celebra-  
tyng of festiuall dayes. The Athenienses began it at the  
Sunne sette or goyng downe of the Sunne. The Babi-  
lonians at the rysyng of the Sunne. The Vmbrians and  
Ethuscos, from the myddaye or noone, and ended it the  
next noone solowynge. In this maner do the Astrono-  
mers begynne it : And synde that the day shall euer be-  
gynne at one selfe same houre for the equalitie of the Me-  
ridians. And yf they had begunne it from the rysyng or  
fall of the Sunne, it should not be euer at one selfe same  
houre, because the Sunne ryseth and falleth at some-  
tymes sooner, and at other tymes later : and so shoulde  
the begynnynge of the day be variable. And it is to vn-  
derstand, that when we commonly say, at the tenth day  
of such a moneth, the same tenth day doth ende the same  
day at noone. And the houres that run from that noone-  
tyde forwarde, are of the eleuenth daye : and so do the  
Astronomers accompt them.

The ende of  
the naturall  
day.

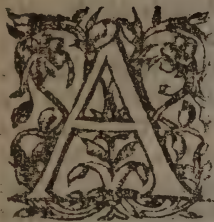
The artifi-  
ciall day.

The nyght

The day artificiall is part of the daye naturall, and  
is the tyme that the Sunne tarjeth from that it ryseth  
in the East, vntyll it fall in the Weste. And the nyght  
is that part that lacketh or fayleth for the naturall daye:  
whiche is the tyme that the Sunne tarieth from that he  
hydeth hym selfe in the Weste, vntyll he returne to ap-  
peare in the East. And so the day artificiall & the night,  
make one naturall day. And accorpyng hereunto, it is  
wrytten in the Genesis, that of euening and moornyng  
was made one daye. Isodorus defininge this artificiall  
day, saith that the daye is the presens of the Sunne, or  
the beyng of the Sunne aboue the earth : as it is nyght  
vnto vs when he is vnder it. Or otherwyse: the nyght  
is the shadowe of the earth extended Diametrallye a-  
gaynst the Sunne. The quantitie and differences of  
these dayes artificiall and theyr nyghtes, and howe they  
increase and diminishe, we haue largely declared in the  
first Chapter.

The

# The. xiiii. Chapiter of houres.



As there is two differences of the day,  
as the naturall daye, and artificiall:  
so is there two differences of houres,  
as houres naturall which correspond  
to the naturall daye: and houres ar-  
tificiall, which corresponde to the ar-  
tificiall day. Hora oꝝ Ora is a Greeke  
name, and signifieth ende. And so say

Houres are  
naturall and  
artificiall.

we Ora maris, foꝝ the ende oꝝ bymme of the sea, oꝝ the  
lyste oꝝ edge of apparell, as saith Ilodore in his Etimolo-  
gies. The houre naturall oꝝ equall, is a. 24. parte of the  
day naturall: And is the tyme of passyng. 15. degrees of  
the Equinoctiall. These. 24. houres that make one na-  
turall day, the Astronomers accompt from that the sayd  
day begynneth, which is from the Peridian toward the  
West: and they come to be the. vi. houres in the ryght  
Horizon of the sphere: and the. xii. in the Peridian in  
the angle of mydnyght, and the. xvi. in the ryght Ho-  
rizon to the East parte: and come to end the. 24. houres  
in the same Peridian where they began. And this they  
use foꝝ the computation of the tables of the mounges of  
the heauens. The Astronomers use the same in theyꝝ  
instrumentes, as in the Astrolabe, and Dyalles Hozi-  
zontall and verticall, and in all other instrumentes foꝝ  
houres. In Spayne also we use to accompt these. 24. in  
two tymes twelue, begynnyng at noone, and endynge  
xii. at mydnyght: and agayne, begynnyng at mydnight  
and endyng other twelue at noone. And to distincte the  
one from the other, they call the one afternoone houres,  
and the other fozenoone houres: And commonly we say  
syre houres of the moꝝnyng, and sixe of the euenyng. In  
Italy they accompt them from the fallyng of the Sunne  
vntyll the next fall the daye folowynge.

The houre  
naturall oꝝ  
equall.

The artificiall oꝝ temperall houre, is a twelfth  
parte of the daye arcke oꝝ the nyght arcke.

The houre  
artificiall oꝝ  
temperall.

They



The day &  
nyght deu-  
ided into.iiii.  
partes.

Interpreta-  
tion of cer-  
teyne places  
of the Gof-  
pell.

The nyght  
deuyded in-  
to foure  
quarters.

foure wat-  
ches of the  
nyght.

They are called temperall houres, because they vary in the tymes that the day varyeth. For in the time that the dayes shalbe greate, so shalbe the houres. And when the dayes shalbe shorte, so lyke wyse shall the houres be, and in lyke maner of the nyghtes. So that, as the artificiall day great or lytle, is deuided into other. 12. houres, euen so the night great or lytle is deuided into other. 12. The auncientes deuided the day into foure partes, & the nyght into other foure: geuyng vnto euery quarter part three houres. At the rysyng of the Sunne, whiche was the fyrst houre of the fyrst quarter, they called the fyrste houre: and three houres passed, they called the thyrde houre: and fyve houres passed of the day, they called the fyrt houre, which was the mydday or noone tyde. Also the nyynth houre, they named at nyne houres past of the day. And the Sunne sette or going downe of the Sunne they called the Euenyng: as saith the Poet Virgill in this bearse.

Ante diem clauso componet vesper Olimpo.

And accoꝝdyng to this computation, is to be vnderstode that writeth Saint Mathew: That the labourers came to the Vineyard at the eleuenth houre: wherby is ment the fift houre, one houre before the Sunne was set. And when we reade in saint John: The ague lefte hym the seuenth houre. &c. By this accompt it was one houre after noone when Christe healed the sonne of the Ruler that was diseased in Capharnaum. In lyke maner, by these houres the auncientes diuided the night into foure quarters, geuyng three houres to euery quarter. And in these foure partes of the nyght were souldyers appoynted to watche. In the fyrst quarter (which they call Canticinu and we the fyrst sleape) they watched all. In the seconde whiche they called Intempestum, beyng the turne of midnyght, the pong men watched. In the thirde whiche they called Gallicinium, of the crowyng of the Cokes, watched the souldiers of middle age. In the fourth and last quarter, called Matutinu or Antilucanu (that is the spryng of the day) the old souldiers watched. And thus is vnderstode the fyrst, the seconde, and thirde watche

watche of the nyght. In like maner ought the mariners to kepe watche and warde, to auoyde aswell the perylls of the Sea, as also the daungers of Routers: and to deuide the nyght by quarters after the maner of the soldiours, as did also the mariners in olde tyme.

Howe mariners ought to watche.

## The.xv.Chapiter of the making and vse of a vniuersall Diall for the daye.



Here as in the Chapiter before, wee haue entreated of houres & their differences, we entend here to describe the making of an instrument generall, to knowe the houres of the daye by the beames of the sunne: whiche is doone in this maner. Take a rounde plate

To knowe the houres of the day by the sunne.

of laton, and let it be called the Equinoctiall circle: The circumference wherof, you shall deuide into. 24. equall partes by both the sydes. And from the center to euery of these partes, you shall drawe a ryght lyne: one of the whiche, shalbe a meridian. And in the one part of that, wyte. xii. which shalbe the houre of the mydday or noone. And in the other parte, wyte other. xii. whiche shalbe for mydnyght. In the hyghest part turnyng vpon the center, towarde the ryght hand, wyte one, two, thzee, foure. &c. In the lower or nether part, you shall counte towarde the left hande, turnynge it vpon the centre: so that the one houre of the one part come vpon the lyne of the one houre of the other part: In lyke maner two vpon two, thzee vpon thzee, and so forth of the other. And note that in the lyne of syre at after noone, and at the lyne of syre in the moorning, there remaine certen rounde pieces, corners, or endes, after the maner of aris, of the thickenesse of the selfe same plate. Then make a halfe circle of the same metall, as bygge as the halfe circumference of the plate: and of the thickenesse of a piece of. iiii. rials of plate or sumwhat more, such as the plate it selfe: and of the breadth of halfe a



*The .2. part.*

fynger if the instrument ſhalbe greate, or leſſe if the inſtrument ſhalbe leſſe. This halfe circle, ſhall you gradu- ate or deuyde into, 180. degrees, begynnynge at the one ende, one, two, thre, and ſo ſooztv vnto. 90. in the myd- deſt. And the lyke ſhall you doe from the other ende vnto the ſame. 90. Alſo you muſt number them in the bzeadth of the ſame halfe cyzcle. And this halfe circle, ſhall you make faſt on the nether parte of the inſtrument, ſo that the endes therof may be fxyed in the endes of the Meri- dian line. Then thzough the center of the plate or Equi- noctiall cyzcle, ſhall paſſe a rounde ſtyle or wyze of the ſame metall, made faſt or ſothered in it: ſo that it ryle or come ſozth equally frō euery ſyde of the plate the fourth parte of the Diameter of the ſame. And this ſhalbe cal- led the Aris or axiltre of the worlde. The inſtrument be- yng thus made, you ſhall place it or ſet it in a frame ha- uynge two armes, ſtandardes or arches, ſo that it hange betwene the ſayde arches, bozne vp by the rounde pierces or endes of the plate leſte therof at the endes of the lyne of the ſyre houres afore ſayde: In ſuche ſozte that beyng thus ſtayed, it may be directly tourned. And in the myd- deſt betwene theſe twoo armes, beneath in the foote of them, or where they are placed, you ſhall rayſe a pyzcke or poynt: ſo that the plate which ſignifieth the Equinoctiall, beyng perpendicular, the byzmine or edge thereof may fall vpon the poynte or pzicke. And conſequentlye the plate ſtandyng playne or flat, the. 90. degrees of the halfe circle, muſt ſhewe or touche the ſayd pyzcke: as ſhal alſo the ende or extremitie of the Aris of the worlde: And the other ende ſhall ſhewe the Zenith or verticall poynt. This inſtrument muſt bee ſo placed that the Meridian lyne be North and South: whiche you ſhall ſende in this maner. In an open and playne place where the Sunne ſhyneth ſoz the moſte parte of the daye, you ſhall make a circle with a payze of compaſſes. In the myddeſt wherof, you ſhall ſet a ſtyle or wyze ſo vpryght that it declyne not or bende not, eyther one waye or an other. And the ſame no longer then the fourth parte of the Diameter of the circle, Then in the mozynge when the Sunne riſeth, the ſhadowe

The placing  
of the inſtru-  
ment.

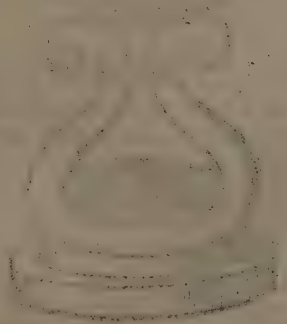
The finding  
of the Meri-  
dian lyne.

Shadowe shalbe very longe. And as it ryseth hygher and  
 hygher, so the shadow wareth shorter and shorter. Then  
 must you obserue the tyme when the extremitie or ende of  
 the shadowe toucheth in the circumference of the circle.  
 And where it toucheth, you shall make a pycke. Then  
 goeth the shadowe shortening vnto the mydday or noone  
 tyme. And as from thence the Sunne declineth, so doeth  
 the shadowe increase. And when it shall come agayne to  
 the circumference of the circle, you shall make an other  
 pycke. Then shal you part in the myddest, the arke that  
 is betwene the one pycke and the other. And from the  
 myddle pycke, drawe a ryght lyne to the center of the  
 circle: And that shalbe the Meridian lyne, whereupon  
 you shal set the instrument. Furthermoze in the foote of þ  
 frame of the instrument, you shal set a compasse or dyall  
 which shal shew the Meridian lyne. This done, vpon the  
 arches of the frame & corners of the syre houres, you shal  
 turne the Equinoctiall so farre that it passe so muche of  
 the halfe circle by the myddle pycke howe many de-

grees the pole is rayled aboue the Horizon of  
 that region or place where you are.

And then the shadow of the wyze  
 or stile, shall iustly shewe in  
 the plate, the houre, and  
 what a clocke  
 it is.

The eleuatiō  
 of the pole.





The .2. part.

¶ Here foloweth the Figure of the Instrument.



The

# The. xvi. Chapiter of certaine particular Dials Murall and Horizontall.



Among sundrie maners and fashions of  
particular Dials, there are two pryn-  
cipall. Wherof the one is Orientall,  
whiche is placed in the superficiall of  
the Horizon. The other is verticall, &  
must be made or set on a wale perpen-  
dicular, and directly against the south  
or mydday, from the poynt of the true

Dials hori-  
zontall and  
verticall.

leuant or east, to the true ponent or west, the whiche the  
Mariners call East and West. To make any of these  
two dials, you must drawe a ryght lyne and call it the  
Aris of the poles of the worlde, vpon the whiche, you  
shall drawe an halfe circle and deuide it in. 90. equall  
partes. And wher the half circle is cut with y<sup>e</sup> lyne of the  
Aris, must be accompted by the circumference, the alti-  
tude of the pole for the citie or place for the whiche you  
intende to make the dial. And in the poynt of the circum-  
ference where endeth the altitude of the pole, you shall  
make a marke: and wryte there, the altitude of the pole.  
And from that poynt drawe a ryght lyne vnto the point  
where you began to accompte the altitude of the pole.  
Whiche lyne shalbe called the Simidiameter, or half Dia-  
meter of the verticall circle. And from the same poynt of  
the altitude of the pole, drawe an other ryght lyne to the  
other extremitie or ende of the Aris. And this shalbe cal-  
led the Semidiameter of the horizon. And likewise fro  
the same poynt of the altitude of the pole, drawe a right  
lyne perpendicular vntill it touche in the Aris. And this  
shalbe called the Semidiameter of the Equinoctiall.  
Hereby is considered a triangle whiche hath by the sy-  
des thereof the Semidiameter of the verticall, the Se-  
midiameter of the Horizon, and the Aris of the worlde,  
whiche triangle shal serue afterwarde. These three Se-  
midiameters, of the verticall, the Equinoctiall, and the  
Horizon, beyng founde, you shall make the Diall in this  
maner.

Call y<sup>e</sup> west

The trian-  
gell.



The making  
of the diall.

Draw a ryght line somewhat long and call it the line of contingence. This shall you cut with an other lyne in ryght angles after the maner of a T. whiche shall be the meridian lyne. Then with your compasse, take from the triangle the Semidiameter of the Equinoctiall. And of this bygnes, drawe a circle vpon the meridian lyne: so that the edge or bymme of the circle, touche in the lyne of contingence. Then with a compasse, take the Diameter of the verticall circle, if you wyl make a mural dial: Or the Semidiameter of the Horizon, if you wyl make a Horizontal dial on a playne or flat forme. Therfore with suche Semidiameter as you desyre, you shall drawe a circle vpon the other parte of the Meridian line, so that the circumference therof touche in the lyne of contingence. Then shall you deuyde the Equinoctiall circle into foure equall partes. And the quarter that is towarde the lyne of contingence, shall you deuide into syre equall partes. And setting the ende of the ruler in the center of the Equinoctiall, and vpon every poynte of them that deuyde the syre equall partes, from thence shall you drawe certayne ryght lynes, vntyll they touche in the lyne of contingence. And from these poyntes of the lyne of contingence, you shall drawe other ryght lynes to the center of the Horizontal circle: which lynes shall be the determiners of the houres. And neare vnto the Meridian lyne where it toucheth in the lyne of contingence, you shall wyte. 12. And consequentye towarde the East, you shall wyte. 1. 2. 3. 4. 5. 6. And from this syxt houre, you shall drawe a ryght lyne whiche shall passe by the center of the Horizon, and be equally reuidered from the lyne of contingence. The one quarter of the Horizon being drawn by the self same and of the same measure and bygnesse, shall you drawe the other, in such sorte, that the same bignesse that is from. xii. to one, the selfe same shall you geue fro the. xii. to the. xi. And the same byggenesse and measure that is from one to two, shall you gyue from. xi. to. x. and so forth of the other.

And note that the Horizontall dyall, after the syrte houre of the euenyng, shall haue the houres of. vii. and viii.

liiii. And in climates farre North. i. also, and moze yf  
 nede shal requyre. And consequently must haue the hou-  
 res of fyue and foure of the moynynge. And in climates  
 farre North, thye also. And these must be so market that  
 from fyre to seuen, may be the same that is from fyue to  
 fyre, and from seuen to eyght, the same that is from four  
 to fyue. Also foure and fyue of the moynynge, as seuen and  
 eyght. The dyall beyng thus drawen in paper or on a ta-  
 ble or any other thynge, must be paynted (on a table or in  
 stone, or in whatsoever you desyre to make the dyall) a  
 circle of the same bygnesse as is the circle Horizontall.  
 And in that, must be translated the lynes and nombers  
 of þe said circle Horizontall. Then must you make a trian-  
 gle of metall of the selfe same bygnesse and fourme that  
 is made in the myddle circle. And the syde of this trian-  
 gle, (which is called the halfe Diameter of the Horizon)  
 must be fyred vpon the meridian lyne of the Horizontall  
 dyall: So that the syde of the triangle (which is the axis  
 of the worlde) and extremitie or ende therof, may fall in  
 the center of the Horizontall dyall, and must stande so  
 perpendicular that it declyne neyther to the one part nor  
 the other. The dyall beyng thus made, you shall sette it  
 vpon a meridian lyne, so that the meridian lyne of the  
 dyall may stande or rest vpon it. And so shal the shadow  
 of the triangle shewe the houre: And if for this place we  
 desyre to knowe it, we must fyre it there. And if for anye  
 other place, so setting it we shall haue a certen houre.

So maye we in an instant remoue it to an  
 other place, and lyke wyse set it there  
 to make certen and true demon-  
 stration of the houre.

Howes of  
 the horizon  
 tall diall.

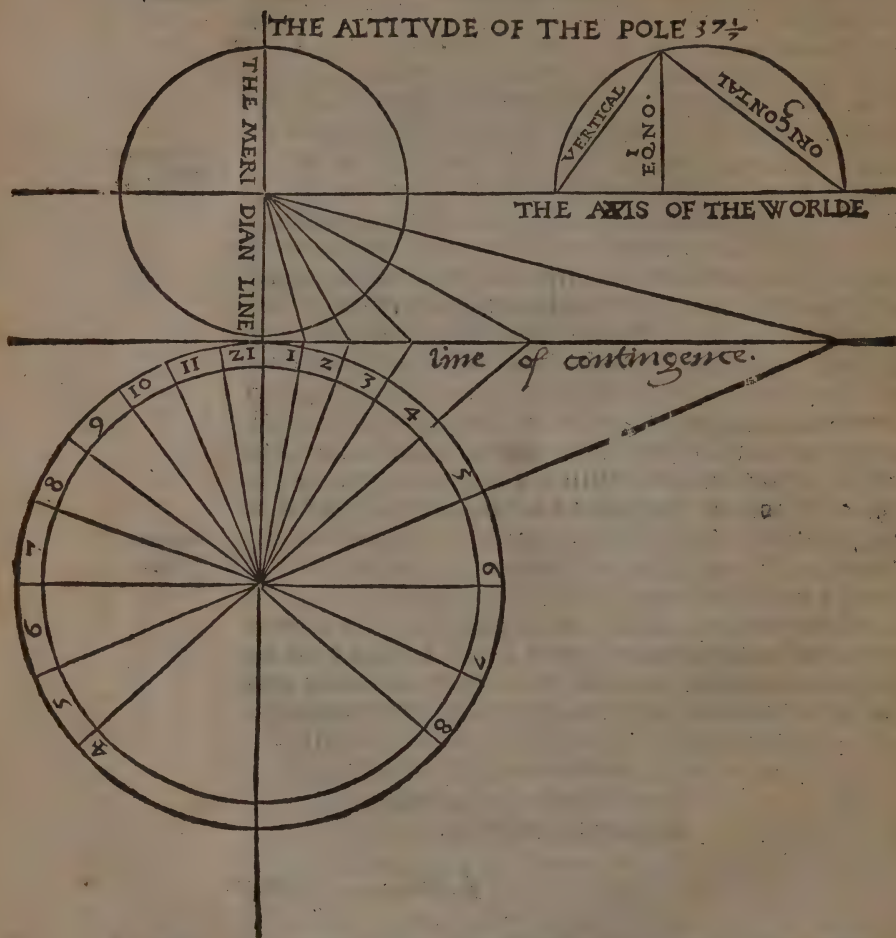
Placing of  
 the diall.

The meridi-  
 an lyne of the  
 diall.



The 2. part.

¶ Here foloweth the figure of this demonstration.



The manner  
of the  
vertical dial

In lyke maner as is made the Horizontall Dial, must be made the verticall, takeinge from the triangle the Semidiameter of the circle verticall.

And note, that for the circle verticall, it shall not be needeful of moze then sixe houres befoze noone, and other syde

fyre after noone. And the triangle must be firt in the meridian lyne vpo the side that is called the Semidiameter of the circle verticall. And if you wyll not make a triangle of metall, but that a wyre of Iron may geue the shadowe, then must you make the sayde triangle of paste or paper. And according to the forme or paterne thereof, make the wyre of Iron, and cause the same to be set in all sortes of dyals as is beforesayde.

## The.xvii.Chapiter of the composition and vse of an Instrument general for houres of the nyght.



Here as in the Chapters past, I haue described the maner and forme, to make two dials for the houres of the daye, me lemeth that for the moze perfection of this worke, it should be conuenient heare to teache the making of a diall, to knowe the houres of the nyght by the circle whiche the two starres called the Guardians or the mouthe of the horne, doe describe by the mouyng of the first moueable. But for as muche as it is a common opinion that in the myddest of Apryll, it is mydnight when the Guardes be in y head, wherof they take the beginning of the yeare: I wyll declare howe it ought to be vnderstode. Certaine it is, that to be mydnyght, is none other thng, but the Sunne to be by the mouyng of the first mouable, to every one in that parte of his meridian that is to hym vnder the earth: Euen as is to hym myddaye or noone, when to hym it is in that part of the Meridian that is aboue the earth. And in this present yeare of. 1545. (to be out of doubt hereof) I made experience with a pccise Astrolabe: so that the fyrrst or formoste Guard starre beyng perpendiculatlie ouer or aboue the North starre, I founde in the Meridia where the sunne maketh mydnyght, the nyynth degree of Taurus. Wherby it foloweth, that the sunne beyng in this degree which is at the. xix. of April, the same garde starre shalbe perpendicularly ouer the North starre,

The garde  
starres.

what is mid  
nyght.

Noone or  
mydday.



*The. 2. part.*

Whiche is the lyne of the head. And consequentlye the Sunne beyng in the nyynth degree of Scorpio, whiche is at the. xxi. of October, the guard starre shalbe in the line of the feete. And by this calculation maye be knowen when it shalbe in the ryght arme or the lefte, and in all the other lynes. So that they manifestlye erre that accompte the mydnyght at the. xv. of Apryll, when the fyrst guard starre is in the line of the head: accompting a terce or thyrde parte of an houre soner and moze then they should doe.

An error.

The making  
of the instru-  
ment.

Having thus given principles for the instrument, you shall procede in the making thereof as foloweth. In paste, or on a plate of laton, make a circle of the quantitie of a spanne, or of the bignesse that you desyre the instrument or dyall to be. Then make an other circle some what lesse: so farre dissaunt from the greater that betwene the one and the other may be a space in the which may be sygned or marked the dayes and monethes. Lyke wyse shal you make an other lesse circle, leauing space to set the numbers of the dayes of euery moneth. And vnder this circle, shall you make an other, leauing space to wyte the names of the monethes. Then shall you diuide the fyrst and greatest circle, into eyghte equall partes. So that the. xix. of Apryll may bee in the hyghest or hyppermoste parte of the instrument, whiche is where they say the lyne of the head to be. And the. xxi. of October must be in the nether part. Also the. xiii. of January, in the ryght arme. And in the left arme, the. xvii. of July. And so the other dayes that doe fall to the other lines according as they aunswere to the ryght ascension of the Sunne, as you may see in this figure.

This



This being thus deuided, you must also deuide the spaces that are betwene the one lyne and the other, into the dayes whiche be numbered in euery space: So that betwene the. xii. of Apryll and the thyrde of Iune, are 45. dayes. And that space shall you deuide into. 45. partes. And where as the instrument beyng small, it cannot in so lytle space receaue so many partes, you shall deuide it from fyue to fyue partes. And so shall you deuide the other spaces by the numbers that are signed in them. Then one daye more before the. i. towarde the left hande, you shall make a stryke, and there shall be the. xi. of Apryll. And fyue dayes more before, make an other stryke: & there shall be the. xvi. And yet other fyue dayes more before, (whiche shall be the. xxi. of Apryll) make an other stryke ouerthwarte vnto the nethermoste circle, & there shall May begynne. And from these dayes shall you begynne to accounte the dayes of May from fyue to fyue. And in the laste space, you shall put fyue, whiche shall make the one and thyrty dayes that May hath.

And



*The. 2. part.*

And there shall you make an other stycke whiche shall traaverse or ouerthwarte vnto the lesse circle. And in this maner shall you deuide the other monethes, geuyng to euery of them the number of his dayes.

This being done, vpon the outward part of the great circle, you shall cut rounde the paper, past, or plate of laton: leauynge of the same for a signe or marke, a floure deluce vpon the. xix. of April, for that it must be the head. And lykelysse at the. xxi. of October, may be left a hande to holde it by. Then must you make a rundell of the same paste or laton of the bygnesse of the lesse circle, without the circumference wherof, shalbe left a toothe or inder, in the whiche you shall wyte: tyme. And from the one syde of this inder toward the left hande, you shal drawe a ryght lyne that may passe throughe the center to the circumference. And this shalbe the Meridian lyne. Also to this roundell shall you geue a circle, so muche lower from the circumference, that there may be left a space where the numbers of the dayes may be wytten. And this roundell you shall deuyde into. 24. equall partes: begynning at the meridian lyne of the inder at the twelfth houre of the nyght. Then in the next space toward the left hande, you shall make the number of one. Lykelysse in the seconde space the number of. ii. In the thyrde the number of. iii. and so forth of the residue vnto the other. xii. of the daye, in thopposite or contrary parte of the inder. So consequently proceadyng. i. ii. iii. &c. vnto the. xii. of the inder, whiche shalbe the. xxi. houres of the naturall day.

The horn of  
the. vii. star-  
res whiche  
make the left  
beare.

Furthermoze also you must make an other piece of the same substance of past or metall, in maner of a horne, in forme & order as are in heauen the seven starres which make the lesse beare. And this of such quantitie that the fyrst or formoste guard starre, may reache withoute the great rundell close to the circumference therof: hauyng the north starre his center with the center of the instrument. And from this starre or center vnto the fyrste and formoste guard starre, must be a right lyne by the which the horne must be cut neare from the center vnto the dis-  
couering

coueryng or shewyng of the houres. Also from the fyrst garde to the second, must be two partes of nyne of that that is from the starre whiche signifieth the North, to the fyrst garde. Againe, the second & last garde, must be toward the left hand ouer or aboute the first, the quarter partes of one halfe circle (whiche hath for the Semidiameter the two partes of nyne whereof we haue spoken before) geuen vpon the ryght lyne that goeth from the North to the fyrst garde. These two garde starres, must be bozred thzough with holes of the byggenesse of an aglet of a poynt. And lykelysse the North starre, with also the two roundels thzough the center: And by that all thzee pieces annered: so that there remaine a hole in the myddest lyke the holes of the guardes. So that by it, and by the other of the guardes, may be sene the starres in heauen: In suche sorte that the lesse roundell and the bozne, may be turned round about the Axis, as doth appear in the demonstration following.





To find the  
houre with  
the instru-  
ment.

The instrument thus ended and brought to perfection,  
when you desyre to knowe the houre, you shall turne  
the inder of the lesse rundell (in the whiche is wyrtten  
tyme) to that part of the great rundell where is marked  
the daye in the whiche you desyre to knowe the houre:  
And directynge your face towarde the North, you shall  
make the head towarde the heygth of heauen, at the.19.  
of Apryll.

of Appyll. And seying in heauen by the hole in the myddest the starre of the North, holdynge the instrument in suche compasse of the face, that by the circumference of the greater rundell may be seene the Guard starres in heauen, you shall turne the horne rounde about, vntyll it fall vpon the Guardes: so that by the two holes of the mouth of the horne, the two Guard starres may be seene, and by the hole in the myddest the North starre, and all thre with one eye: Then the right line that goeth from the North to the fyrste Guard, shall shewe in the lesse rundell the houre that shalbe.

## **C**The.xviii. Chapter of the tyme of the Tydes, or rysing and falling of the sea.



Greate accompte ought Pilottes and Maryners to haue of the Tydes, to take port, enter vpon barres, passe by flattes: and finallye for all maner of Nauigations. For being ignoraunt hereof, great hurt and inconuenience myght chaunce vnto them: as dyd of late to the valient Captayn Don Iohn Gusman Therle of Niebla, in the yeaere of. 1436. who was drowned befoze the Citie of Gibraltar, for that the Mariners kept none accompt neyther had consideration of the tydes. By reason wherof, not only he was drowned, but also with hym dyed many worthye gentlemen and valient capitaynes of Spayne.

The Maryners holde for a certen rule, that the Moone being in the Northeast, or in the Southwest, is full sea: And beyng in the Southeast, or Northwest, to be lowe water. They affirme also, that at the fyrst day of the newe Moone, the Sunne beyng at Northeast and a quarter to the East (that is Northeast and by East) the Moone shalbe Northeast: And then shall be full sea, and thre houres, and thre quarters.

And

The Maryners opinio  
of ebbing &  
flowing of  
the sea, or  
tydes.

Observaci  
of the moone  
to know the  
tydes.



The. 2 . part.

Lyght prin-  
cipall wyndes

And at the seconde day of the Moone, when the Sunne shalbe at East North-east, the Moone shalbe at North-east, and then shalbe full sea, and foure houres and two quarters. &c. They accompt is, that the Sunne beyng in the North is mydnyght: and being in the North-east they accompt thre: and in the East, sixe. So that they accompt thre houres from wynd to wynde, by the. viii. principall wyndes, or lines which the Spanyardes call Rumbos. These wyndes muste be imagined vppon the North, placed in the angle vnder or beneath the earth: and the Sunne and the Moone at the mouing of the first mouable. And they ought not to be imagined in the Horizon, as the compasse sheweth. For speakyng by the termes of Astronomie, you muste vnderstande that the Moone touchyng in the circle of houres, at the number of thre, is euer full sea. And touchyng in the same circle at the number of nine, is euer lowe water. No lesse ought they to obserue iust accompt of the houres by quarters of houres. For, to geue. 32. dayes to the Moone, it shalbe necessary to accompte by the fyftes of houres, as shalbe sayde hereafter.

Here is to be noted, that the Spanyardes thynke (be lyke) that a North-east and South-west Moone, maketh a full sea in al other places as it doth in Spayne. But in that they are greatly deceaued. And therefore the rule that they haue sette forth for the tydes, serueth onely for such places where it floweth North-east and South-west moone a full sea.

The moone  
causeth the  
the ebbing  
& flowyng  
of the Ocean  
sea

The mouing  
of the moone

And the better to vnderstande the increasyng and decreasing of the Ocean sea, it shalbe couenient to knowe the cause therof. Wherunto we saye, that the moone is the cause of ebbing and flowyng, or rysyng and falling, increase or decrease of the sea: Not onely by her lyght, but also by her secrete or hyd propertie. The moone compasseth about the earth from the East into the West, vntyll she returne to the place or poynt from whence she departed. And in this course wasteth or spendeth so much more then one naturall daye, in howe muche her proper mouyng is more then the Sunne against the fyfth mouable.

able. So that she maketh her tourne or course about the foure quarters of heauen in. xliiii. houres & foure fiftes of one houre: whiche are the. xii. degrees that she goeth moze then the Sunne. And in this tyme the Ocean increaseth and decreaseth twyse. So that this increasyng and decreasyng, aunswereth directly to the course of the Moone. Whereby it foloweth that the Sea increaseth six houres & one fyfte parte, & decreaseth other six houres and one fyfte. And if this daye at the. xii. houre was full Sea, the lowe water shalbe at the sixte houre and one fyfte parte. And at the. xii. houre and two fyfte partes, it shal retourne to be full Sea. And at the sixte houre & thye fiftes, shalbe lowe water agayne. And at the. xii. & foure fyftes of the other daye, shalbe full Sea. So that from one daye to an other, the tyde doeth *growen* foure fyftes of an houre, whiche is the tyme that the Moone slacketh or tarieth moze then one natural day, to retourne to the pointe from whence she departed by the. xii. degrees wherof we haue spoken. Whereby it manifestly appeareth how they beguyle them selues that say that the Sea increaseth six houres, and decreaseth other six. For if it were so, the tydes shoulde euer bee at one selfe same tyme and houre. But for as much as there is moze then. xliiii. houres by the sayde foure fyfte partes, there is caused the variation of the tydes: So that yf this daye, the tyde be at one of the clocke, to morowe it shalbe at one and foure fyfte partes. And the daye folowynge at two of the clocke and thye fiftes. &c.

*The growen  
ing of the  
tyde.*

*An error.*

*The varia-  
tion of tides*

For this accompt, I wyll describe a table in circular figure: althoug not precise for the causes which we haue touched before in the first chapter speaking of the Moone: who sumtymes in her mouing is swifte, and sumtymes slacketh as much, bycause the conjunction is not euer in one selfe same poynte of the Zodiack, as the mariners presuppose for their rule. This figure shal haue two circles. In the lesse (whiche shalbe the first and next vnto the center) shalbe the dayes of the Moone from one to. 30. whiche we counte the conjunction. And in the seconde & greatest circle, shalbe founde the houres of the tydes. So

*A table to  
know the va-  
riation of the  
tydes.*

Gi. that,



that, who so desyret to knowe when the tyde shal be, where it floweth Southwest and Northeast, let hym at that houre take heade to the dayes of the Moone holwe many they are: as if the be in the coniunction, or if it be the fyrst or seconde of the Moone. &c. And the day beyng knowen, then in the seconde cyrle whiche aunswereth directly to the daye, shal he fynde when shal be hygh water or full Sea: and consequently the ebbe or lowe water, whiche shal be fyve houres and one fyfte after the full Sea. And so likewise may he iudge when shal be the half tyde. And this aswell at the tyme when it increaseth, (whiche shal be thre houres and halfe a fyfte parte of an houre before the full Sea) as also when it decreaseth: whiche shal be the halfe ebbe, thre houres and half the fyfte of one houre after the full Sea.

The Table foloweth.



This increasing and decreasing of the tydes, is not ever in equall quantitie. In the coniunctions and oppositions, they increase and decrease muche: Whiche the Maryners call hygge spyngge tydes. And the greatest increase of all, they call the hygge spyngges. In the quarters of the Moone, (which are at the. 7. and the. 22. of the Moone or neare there about) they increase and decrease but litle: Whiche the Mariners call nepe tydes, lowe ebbes, lowe waters, dead waters, or lowe fluddes.

## The. xix. Chapter of certen

signes whiche prognosticate Tempestes or fayre weather.



Good Pilote or Mariner ought not to be ignorant of certen signes or tokens whiche the naturall Whylosophers describe of tempestes. For as they signifie vnto him, so shal he leane his porte or enter into it. Whiche if he can not, then ought he with patience and hope to tary the time that God hath appointed for hym, who moueth & troubleth the Seas when it pleaseh hym, & appealeth them againe at his pleasure. Lesse hurteth & damageth the stroke which we se coming or foylee, then that which hath stricke vs & taken vs carelesse. When the Sunne riseth faire & cleare, it signifieth a fayre daie. But if it shew yealow or deadly, tempest is like to folow. Again, if at the rising of the sunne, his beames shew them selues contracte or gathered together & short, you shal haue raine. If the mistes or cloudes make a circle about the Sunne or Moone, how much the greater that circle shalbe, so much greater shalbe the tempest to come. And if there shalbe two circles, the tempest shal increase the more. And if it chaunce that at the rising of the sunne, the cloudes be turned red, it is a signe of no smal tempest. When the Sunne or the Moone shal haue a circle, loke toward the part where it breaketh, & from thence shal wynd come. If it depart or disperse equally, faire wether shal folow. When the Moone riseth bright & shyning with pure colour, you may iudge it faire wether.

Signes of  
fayre and  
foule wea-  
ther.



And if redde, wynde. If black, rayne. When in the new  
Moone, the hornes or cornes appeare grose or great, it  
is a token of tempest. And if sharpe, it signifieth sayre  
weather.

The new  
Moone.

This that we haue sayde, is the auctoritie of Plinie &  
Aristotell, to whome the prudent Mariner shal credit un-  
tyll he haue founde other moze certayne, eyther by hys  
owne experience, or by the experience of other wyse men  
wozthy to bee beleued. And euerye manne oughte to  
trauayle as muche as in hym is, for the knowledg of  
these thynges, accordyng as God hath gyuen him vnder-  
standyng and reason to obteyne the same. And this shal  
be wysdom, bearyng in memorie the experie of things  
past, to gouerne presently, and to prouyde for thynges to  
come. The prouidence of God is so great, that depry-  
uyng brute bestes of reason and vnderstanding, he hath  
geuen them sense and naturall instincte, whereby they  
may knowe that, that men do vnderstande by reason.

The sense of  
beastes in  
foresaying tem-  
pestes.

Antes.

By this sense and secrete instincte of nature, the Antes  
or Dissennares, with prouidence and dilligence, laye vp  
in store theyr prouision and egges, when befoze they fele

Swalowes.

Fysshes.

the rayne to come. The Swalowes also when they fele  
the wynter comyng, passe the Seas. Lyke wyse the Fys-  
shes when they perceyue stormes to come, goe downe to  
the bottom of the water and hyde them in the mudde of  
the Sea. And although it may seme besyde my profession  
to meddle with matters perteynyng to Diuines, yet wyl  
I not omitte to speake that Christ our Lorde sayeth, as  
testifieth S. Mathewe. When the Phariseis with the  
Saduces (to tempte hym) willed hym to shewe them sig-  
nes from heauen, he aunswered saying: when it is eue-  
nyng you saye it shalbe sayre weather, because the hea-  
uen is redde. And in the mornyng, you say it shalbe tem-  
pest when you see that the heauen dralweth towarde  
redde. &c. They knewe by that they iudged of heauen, to  
determen thynges to come: As whether it were euell to  
take iourney, to enter the Sea, to reape Cozne, to laye it  
abroade, or to gather it in. I saye that to vnderstand the  
reason that moued them to haue suche consyderation of  
tyme,

Matth. xlii

tyne, (whiche we now we lykelwyse obserue,) it is necessary to knowe that the redde colour which appeareth in the euening, signifieth the drynesse of the ayre: where by the matter of the grosse vapours which should be conuerted into water, is so muche dzyed, that it appeareth in maner inflamed, and is therfore redde. And so is it not aptely disposed to be conuerted into water: And is therfore the nearest sygne of sayre weather. The other sygne when the heauen in the moynyng dzyaweth toward rednesse, (yet not redde) sheweth manifestly that rayne shal folowe. Wherof the cause is, that this matter is ingroced: because this colour can not be but in grosse & thicke matter whiche is not dzyed, and therfore is not redde: as the cloudes that appeare in the West in the tyme of sayre weather: But it is a matter somewhat troubled & partly redde. And is therefore a confounded matter: whiche touched with the heate of the Sunne, and thereby broken and dyspersed, falleth downe and is conuerted into water. And further, as touchynge the sayd troubled or grosse matter, I say that the dzye and ruddy part therof, is eyther tourned into wynde by drynesse, or els beyng compassed about and inclosed with moyst matter, is altogether conuerted into rayne, and so maketh tempest. For by tempest is ment, not onely rayne, but also tempestuous wyndes with water.

The redde-  
nesse of the  
euening.

Ruddy col-  
our.

What is tem-  
pest.

Luke. xii

Lykelwyse it is wyrtten by S. Luke: When you see a cloude ryse in the West, you saye rayne shal folowe. And when the wynde bloweth South, you saye it wyl be hotte. &c. To vnderstande this, I saye the cause of this is, that rayne is made or engendzed of moyste vapours whiche both may be and are ingroced. Or otherwyse, a cloude is a grosse body of moyst vapours so ingroced. And when the cloude doth so ryse, it shalbe a signe that rayne shal shortly folowe. For that that was ingroced in the cloude, shall sone be resolued into water. To the other reason why they say that when y wynd bloweth South, it wylbe hotte, I saye that that wynde is hotte and dzye. Furthermoze is to be considered that y wyndes are sometymes dzye, and sometymes moyst. Yet not by their own

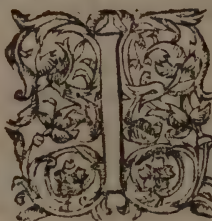
The genera-  
tion of rayne  
or cloudes.

The qualis-  
ties of wyndes.



propertie: but accordynge to the regions by the whiche they passe. We see that in some one Region it rayneth with one wynde: and the selfe same wynde in other places disparseth the cloudes. The Northwest wynde is drye in Spayne. Yet in Libia is it very moyst and rayny. The South wynde in Europe, causeth rayne in mosse places. And therfore the Poetes named it the wynde of waters. And this wynde in Palestina oꝝ Jury, is drye. The cause of this diuersitie, is, that when that wynde bloweth in Palestina, it passeth by hoate and drye Regi-  
ons, as by the desertes of Aphrike, and passeth not by any Sea at all. But when it bloweth in these partes of Europe, it must of necessitie passe by and ouer the waters of the Sea Mediteraneum oꝝ the Leuant Sea, where it gathereth moisture & causeth rayne. The Leuante oꝝ East wynde, in Malaga and Gibraltar, is moyst: And in sheres, De la Frontera, is hoate as hell.

**¶ The. xx. Chapter of the bryght and  
shining exhalations that appeare in tempestes: whiche  
the Mariners call santelmo  
oꝝ Corpus sancti.**



Ignorance is the mother of errours. And therfore wyl I not smit to the we the naturall cause hereof, although among certayne simple and ignoraunt people it is accounted foꝝ a myracle, that in certayne tempestes on the sea, the Mariners see certayne shynynge & bryght fyres which with great super-

stition they knele downe vnto and praye vnto, affirming that it is santelmo that appeareth vnto them. And not contented herewith, some sweare that they haue seene droppes of grene ware fall downe. Other affirme that this ware is of suche heate, that if it fall from the top of the shyppe, it doth melte the rosen and pitche of the hatches of the shyp, with suche other folyshe imaginations. And therfore it shalbe good bryefly to speake hereof to  
stoppe

Some call  
these the fy-  
res of saynt  
Ellen and  
S. Nicolas.

Hoppe the mouthes of suche fonde & ignoraunt persones. The exhalations or vapours of the grosse fumes or smokes that ryse from the earth, are constrained or gathered together by the coldnesse of the nyght and the ayre: & are thickened in the first region of the ayre next vnto the earth. This may and is wont to be inflamed or kyndled. And if it fynde a body whereunto it may cleaue, it abydeth in that vntyll it be consumed. This fyre is cleare & shyning, and yet burneth not. The Grekes call it Polydeuces: and the Latines call it Castor & Pollux. It is accustomed to appeare vpon the throlwdes, and oftentimes is sene vpon the pykes of Soldiours in the armies of me of warre, as Plinie wyrteth. And this aswell by reason of continuall smoke, as also by the heate of muche people. Certayne it is, that smoke is none other thyng then fyre dispersed: as flame is an exhalation or euapozation that ryleth in maner of a smoke from a grosse or fat body: and at the tyme that it ryleth, beyng gathered together, is constrained into flame inuestured with fyre. This resplendence or shyning, is also often tymes sene not only in iourneyng by lande, but also in sayling by ryuers. And when it appeareth on þ lande, it riseth of the smoke that is gathered together with the colde ayre of þ night: and on the bankes of ryuers, this smoke is gathered of the exhalations of the water. And consequently beyng kyndled, appeareth byght and shyning. But now let vs come to the shippes that sayle by the Sea, and to the Mariners that are accustomed to tempestes. To them therfore I saye, that that lyght or suche other lightes as they see, is engendred of the fumes and smokes of theyr shyppe with the heate of men couched close and neare together in a narrow place. And when a tempest ryleth, þ sayd smoke is thickened, prest together, and beate down by the wyndes, in suche sorte that beyng tossed from one syde to an other, it is sette on fyre by mouyng: and taketh holde sometyme on the throlwdes, and sometyme in the top, and sometime also in the poupe or in the foreship: So that to see this lyghte, or the same to appeare, is a naturall thyng, and not supernaturall.

wanderyng  
fiery engendred  
of exhalations  
and vapours.

Castor and  
Pollux.

what is smoke  
he & flame.

Exhalations  
of the lande  
and water.

Exhalations  
& vapours  
engendred in  
shippes.



A hyning  
flye.

A Capetici-  
ous opinion  
of the Mary-  
nors.

A lyfe of the  
fyer prea-  
chers.

Psalm. lxxv

Testimonie  
of ancient  
antours.

When capitaine Bezerra was at Corron in the Empe-  
rours Paue with his companie of Soldiours, he chann-  
ced to be in a tempest and saue the sayd fyre of santelmo,  
whiche shortly after descended so lowe that the Capi-  
taine myght easely come to it. And taking it in his cloke  
he founde it to be a lyttle droppe of water. Some haue  
thought it to be a certayne hyninge flye called Taros,  
whiche the Sea men sometyme see in a calme in the som-  
mer season. And thus Santelmo appeared no moze. The  
Captaine remayned astonysed at the mockerie: and the  
other perceiued it to be no miracle. The opinion of the  
Mariners that affirmed it to be Santelmo, may yse of  
saynt Erasmo Byshop of Paphes: who (as they saye) not  
only in his lyfe tyme but also after his death, was a pa-  
trone and helper of Mariners that called vpon hym in  
tempestes. His name of Erasmo, they of Paphes call  
Cremo. And procelle of tyme takyng awaye one. e. by  
the figure of syncope, remayned the name of Santermo.  
And y Spaniards who neuer can long kepe any straunge  
vocalbe, call it Santelmo, turnyng. r. into. l. Yet of thys  
Santelmo wherof the Mariners speake, ther is neither  
scripture that maketh mention, nor authoritie that con-  
firmeth it. I heare saye that the Fryers preachers had a  
religious man of commendable lyfe and good conuer-  
sation; named Fryer pero Gonzales, borne in Galizia. And  
that in his lyfe tyme our Lorde dyd certayne myzacles  
by hym. And that this is he that shyneth & gyueth light  
in tempestes. No doubte but God worketh myzacles in  
his sayntes and by his Sayntes as sayeth Dauid. But yf  
this seruaunt of God was Pero Gonzales: howe then  
shal he be Santelmo? An other difficultie there is as tou-  
chyng this lyght. For there are wyptynges of moze an-  
tiquitie then the lawe of grace and commyng of Chryste  
in fleshe, whych geue testimonie hereof. For the Poet  
Virgyl in the seconde of his Aeneidos, wyrteth that this  
fyre appeared vppon the head of Iulius Ascanus. And  
Titus Liuius in his fyrste booke, affyrmeth that it appea-  
red vpon the headde of scruus Tullius, the fyrte kynge  
of the Romaines.

Pom.

pomponius Atticus saith, that Rome begynne to be builded in the thyzde yeare of the thyzd Olimpiades. That is in the tenth yeare of Ioathan kynge of the Iewes. And from the creation of the worlde. 3201. yeares : and. 729. yeres befoze Christ our sauour was bozne. The kinges of Rome were seuen, and raigned. 244. yeares. Eusebius saith they raigned. 246. Seruius Tullius raigned. 44. yeares. Tarquinius superbus. 25. yeares after hym. So that discountyng these yeares, it shall appeare clearly as I say. And although the yeares were not discounted let them reade Diodorus siculus an auncient wypter, let them reade plutarchus, Aristotle, and other old auctours that haue wypten hereof. And they shall fynde that yf tempestes be neare vnto the sea, these fyres and lightes appeare in them. And appeared not onelye to the Gentyles, but at this daye also appeare to the Turkes and Moores in tempestes. When only one lyght appeareth it is taken for an euyl signe. And hereof saide propertius thus.

The buye  
dyng of  
Rome.

The Mos  
main kinge

Candida foelici soluit vela toro.

And why it is an euyl signe, this is the cause. That yf the tempest that ysleth be great, it choketh the exhala-  
tion : although yet by the parte leasse troubled it appea-  
reth. When there are two lyghtes, is signifieth that in  
the ayre is great abundaunce of grosse humours. And is  
a token that it is sufficient to consume the matter of the  
tempest : So that the tempest begynneth to cease, & the  
grosse humour hath the masterye. But sometyme it  
chaunceth that two lyghtes appearyng, there maye be  
tempest : and one appearyng shall not be so greute. And  
offentyme there is tempest without any light at al sene.  
The blynde Gentyllitie called these Castor and pollux,  
and placed them in heauen in the signe of Gemini.

One lyght  
or fyre is an  
euyl signe.

Two lygh-  
tes:

Castor and  
pollux.

Nowe remaineth to aunswere to one obiection of  
the Mariners, who say, that neuer man that hath sene  
these fyres hath perished. To this I saye, that manye  
may se and haue sene these lightes : of whom some haue  
ben in peryll and some drowned. Notwithstanding, no  
man can affirme, that yf the drowned myght speake,  
they

An error of  
the Mary-  
ners.



*The .2. part.*

they would saye that they had seene them. Therfore the  
wyse Christian Mariner ought to haue a clear conscien-  
ce, and to call for the helpe of almyghtie God, lystyng vp  
his eyes and handes vnto heauen, and saye with the

Isai. lxviii.

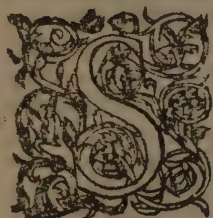
Prophet, Saluum me fac Deus, quoniam in-  
trauerunt aquæ vsque ad animam meam.

Haue me oh my God, for waters  
haue entred euen vnto  
my soule.

**H**ere endeth the seconde parte.

The thynde parte, entreateth of the composition and vse of Instrumentes: and Rules for the Arte of Nauigation.

**The first Chapiter of the nomber, Order, and names of the wyndes.**



**S**olus, kyng of the Eolas Ilandes, or Ilandes of Vulcane, for hauing reason and knowledge of the wyndes, that they of auncient tyme called hym the God and Lord of them. With no lesse consyderation, the prudent Mariner

*why Solus was sayned God of wyndes.*

sought not to be ignoraunt of them, for as muche as the vniuersall benefite and commoditie of Nauigation consisteth therein. And to haue the better knowledge therof, you shall vnderstande that wynde is frute of the ayre, & vapour of the earth. The whiche by reason of his subtiltie, perceith the Ayre, striketh it, and enforceth it. Other saye, that wynde, is Ayre moued or tossed by the vehement influence of vapours of contrary qualitie. It is in Latin called Ventus, because it is vehement and violent. Whose force is so great that it ouerthroweth not onely heapes of stones or rockes, and casteth downe trees: but also disturbeth the Ayre and the earth, and moueth the Seas.

*what is wynde.*

There are foure principall wyndes whiche come from the foure cardinall or principal poyntes of the Horizon. We haue sayd that the Meridian circle cutteth the Horizon in two pointes: (that is) in the North & in the South. And y Equinoctiall cutteth it in other two: that is, in the East and the West. And from these foure pointes come these foure wyndes, wherof also the holy scripture maketh mention. These foure wyndes, thei in auncient tyme named in this maner. That that cometh from the East, they called subolanus, whiche we call the Leuant or East wynde. That cometh from the South, thei named Auster: whiche we call the Meridian or South wynde. That cometh from the West, they called Fauonius, whiche we call the ponent or West.

*The foure principal or Cardinall of wyndes.*

*Leuant.*

*East.*

*South.*

*West.*

That



**North.** That from the North they named septentrio, or Aquilo, or Boreas, which we call North. To euery of these foure wyndes, they adioyned two collaterall wyndes in manner as foloweth. That that is from the Easte toward the parte of the North where the Tropicke of Cancer aryseth or cometh forth, they called Vulturinus. And that is from thence toward the part of the South where ryseth the Tropicke of Capricorne, they called Eurus. Also that is from the west toward the parte of the South, where the Tropicke of Capricorne goeth downe, they call Africus. And that that declineth to the North where the Tropicke of Cancer goeth downe, they call Caurus. The collateralles of the North and of the South, answer to the circumferences of the Polar circles. That that is from the North toward the Leuant or East, they call Aquilo. And that declineth toward the West part, they call Circius. That is from the South toward the East, Euro Ausfer. And toward the West Euro Africus. Thus many hath Aristotle in his Metheora. With these xii. wyndes they sayled in olde tyme, and made theyr compasse by them.

**Diuis. whole wyndes.**

**Diuisiō for the Horizon by the foure principall wyndes.**

**Diuis. halfe wyndes.**

The Hydrographers of late dayes, and suche as are trauayled and exercysed in saylyng, agree with the ancients in the foure principall wyndes: Although they haue chaunged the names, calling the Leuant or Orient, East. The Ponent or Occident, West. The Septentrionall, North: and the Meridionall, South. Betwene these foure wyndes, they deuide euery quarter of the Horizon into two halfes, made of the two nearest in this manner. Betwene the North and the East, taking name of them both, they name the Northeast. Betwene the East and the South, they name the Southeast: And betwene the South and the West, Southwest: betwene West and North, Northwest. These eyght wyndes in nauigation they call whole wyndes.

Betwene these eyght wyndes, they place other. diiij. that are called halfe wyndes: whiche also are named of the two that are nearest vnto them. That that is betwene the North & Northeast, they call Northnortheast. Betwene

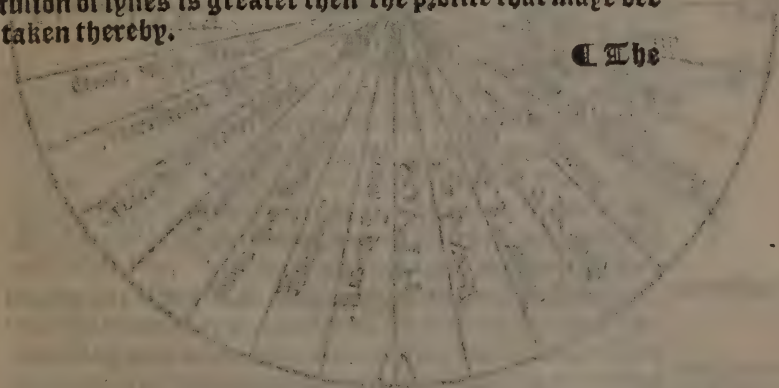
Between North-east and East, is North-east: & so forth of the other. Besyde these halfe wyndes, they haue other whiche they call quarter wyndes. These take the name of the wyndes to the whiche they declyne: As if to the quarter from the North towarde the North-east, they call it North and a quarter towarde the North-east: that is North and by East. And that that is towarde the North west, they call North and a quarter to ward North-west. And so of the other as shalbe verfyed in the fygure folowynge. Whereof is gathered, that deuidyng the eyghte pyncipall wyndes into halfe wyndes, they are. 16. And euery halfe wynde diuided into two quarters, are in all 32. wyndes. Some haue bene so curious, or rather so baynely carefull and to precise, that they haue diuided them into. 64. And in the cardes that they haue, the confusion of lynes is greater then the profite that maye be taken thereby.

Quarter  
wyndes.

The diuision  
of the wyndes.

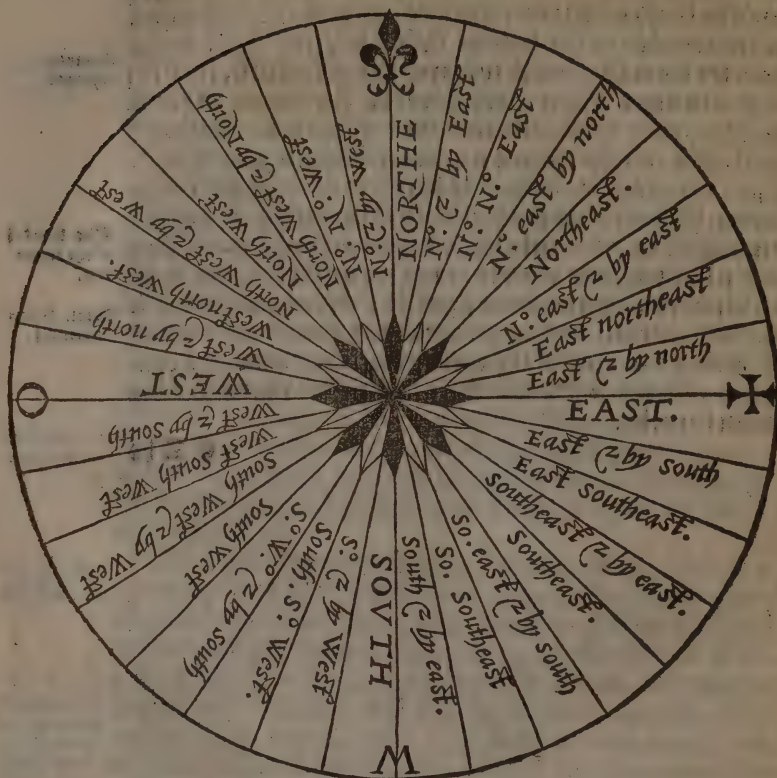
Eight. wyndes  
in all.

The





## The demonstration of the wyndes

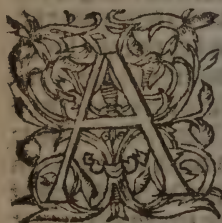


These names do thei vse that saile by the Ocean sea. And it semeth that they had their beginning of the Almaine or Flemyshe tongue. For these nations chieflie, saile in the Ocean. They that saile in the sea Mediterranean, or Leuant Sea, call them by other names, taking originall of the Tuscan or Italian tongue. Or els that they haue denomination of the partes from whence they come in respect of the Sea Mediterranean. As the Wynde called Graco, because it cometh from Grecia, And Libeico because

The names  
of the wyndes  
in the Ita-  
lian or Tus-  
can tongue.

because it cometh from Libia: And Syroccho because it cometh from Syria. And beginning at the North, these are their names, Tramōtana, Græco, Levante, Ponente, Maestro. And that that is betwene Tramontana and Græco, they call Græco Tramontana. And that is betwene Græco & Levante they call Græco Levante. And that is betwene Levante & Syroccho, they call Levante Syroccho. And that is betwene Syroccho and Mezzo Iorno, they call Mezzo Iorno Syroccho. And so of the other: and the like of the quarters. And because they that sayle in the Ocean, are governed by altitudes, we wyll vse the names that they vse, where we intende to entreate of Altitudes. And euery man shall vse them as he lyketh, for as muche as the difference is not in the wyndes, but only in their names.

## The seconde Chapiter of the composition of Cardes for the Sea.



Arriving to the ende desyred (which is <sup>what is no</sup> ~~navigation.~~ <sup>navigation.</sup> the principal intent why I began this worke) I saye that Navigation or saylyng, is none other thing then to iourney or viage by water, from one place to another. And is one of the foure difficultest thinges whereof the moste wyse king hath wyrtten. These

viages doe differ from viages by lande, in thre thynges. For the lande is fyrm and stedfast. But this is flurible, wauiing, and moueable. That of the lande, is knowen and termined by markes, signes, and limittes. But this of the Sea, is vncerten and unknowen. And if in viages by lande, there are hylles, mountaynes, rockes and craggye places, the Sea payeth the same seuen fold with toymes and tempestes. Therfore these viages beyng so difficulte, it shalbe hard to make the same be vnderstode by wordes or wyrtynge. The best explication or inuention that the wyttes of men haue founde for the manifestyng of this, is to geue the same paynted in a Carde. For the draughte or makynge whereof, it shall bee requisite to knowe twoo thynges. Whereof the one is,

<sup>Worshd. xxx</sup>  
The dangers and difficultie of Navigation.

Making of Cardes for the Sea.

the



The wyndes  
or lynes are  
called Rum-  
bas in the  
Spanyshe  
tongue.

the right position of places, or placing of countreys and coastes. The other is the distances that is from one place to an other. And so the Carde shal haue two descriptiōs. The one that aunswereth to the position, shalbe of the wyndes whiche the Mariners call lynes or poyntes of the compasse. And the other that aunswereth to the distances, shalbe the drawyng and pointing of the coastes of the lande and of the Flandes compassed with the sea. To paynte the wyndes or lynes, you must take skynnes of parchement or large paper, of such bignes as you will the carde to be. And in it drawe two ryght lynes with blacke inke, whiche in the myddest shal cut or deuide the selues in ryght angles: The one accordyng to the length of the Carde, whiche shalbe East and West: And the other North and South. Upon the poynt where they cut, make a center: and vpon it, gyue a priue or hydde circle whiche may occupie in maner the hole Carde. This circle, some make with leade that it may be easely put out. These two lynes, deuide the circle into foure equal partes. And euery part of these, shal you deuide in the myddest with a picke or puncte. Then from one punct to an other, drawe a ryght Diametrall lyne with blacke inke; and so shal the circle remaine deuided with foure lines into eight equall partes whiche corespond to the eight wyndes. In lyke maner shal you deuide euery of the eight into two equall partes. And euery part of these is called a halfe wynde. Then drawe from euery punct to his opposite diametrally a ryght lyne of greene or azure. Like wyse shal you deuide euery halfe wynde in the circle, into two equal partes. And from these punctes whiche deuide the quarters, you shal drawe certayne ryght lynes with reed inke, whiche also shal passe by the center; whiche they call the mother compasse or chiefe compasse of the Carde, being in the myddest thereof. And so shal come furth from the center to the circumference. 32. lines whiche signifie the. 32. wyndes. Besyde these sayd lines, you shal make other equal distant to the, & of the self same colours, in this maner. Fro the poyntes of the wyndes & halfe wyndes & passe by the center, drawe certē ryght lines & passe

The mother  
compasse of  
the Carde.

These lynes  
whiche sig-  
nifie to ma-  
ke wyndes.

not by the center, but be equallye deuided to those that passe by the center, and of the same colours and equidistance as are they that passe by the center. And as these lines concurre together aswell in the center as in the poyntes of the windes and halfe windes that are in the circumference of the circle, they shall leaue or make there other. 16. compasses, euery one with his. 32. wyndes. And yf y<sup>e</sup> carde be very great, because the lynes may not go farre in sunder, yf you wyl make there other. 16. compasses, you muste make them betwene the one and the other of the sy<sup>2</sup>ste. 16. poyntes, where the quarters are made with they<sup>2</sup> wyndes as we haue sayde. It is the custome for the most parte, to paynt vpon the center of these compasses a flowre or a rose, with dyuers colours and golde, differencyng the lines, and markyng them with letters and other markes: especiallye signyng the North with a floure deluce, and the East with a crosse. This, besyde the distinction of the wyndes, serueth also for the garnysshing of the carde. And this for the moste parte is done after that the coaste is drawen. And thus much sufficeth for the draught of the wyndes.

The situation of the places, portes and Ilandes in the Carde, accor<sup>d</sup>ing to they<sup>2</sup> proper differences, consisteth in the particuler and true relation of such as haue trauayled them. And therfore for this purpose it shalbe nedefull to haue paterne of coastes, portes, & Ilandes, whiche muste be paynted in the Carde: And these of the best and most approued to be true. And not only to haue paterne well paynted, but also it shalbe necessarye to knowe the true altitudes of the Pole, of certen principall capes, portes, and famous Cities. This done, they must be translated into certen thinne papers and transparent, that may be seene through: and those of the best and finest that may be had, annoynting them with oyle of Line seede, & then dyying them at the Sunne. Then take the paterne or Carde that is to be translated: And reach or stretch it forth vpon a table. Then put the transparent paper vpo the one side of the paterne where you wyl begin. And the paper being made fast vpon the

The places  
yng of many  
compasses  
in the  
carde.

The floure  
or rose of  
the center.

The North

The situati  
on of the  
places, &c.

Translati  
on of the Carde  
from one to  
another.



paterne with plomettes of leade, or a lyttle ware that may easely be taken of, you shall in the transparent paper marke with a fine penne one East and West, and one North and South, or two, vpon those that are seene by the selfe same paper in the Waterne. And this is called traceyng or translatyng. In lyke maner shall you trace all the coastes, Hauens, Portes, Ilandes, Cities, Capes, and Ryuers, as appeareth in the Waterne, vnto the Rockes that come forth of the water, and the knowne bankes. And because this paper doth not suffice, you shall put thereto another, and moze as neede shall requyre. And begyn the translatiō in one where the other endeth, vntyll you haue translated all that you desyre: Not forgettyng to make in euery one, lines of North & South, East and West, to serue for markes after ward. So that the line of North and South of the one paper may ioyne close and euen with the line of the North and South of the other paper that is ioyned to it by longitude.

And the paterne thus translated into these papers, you muste putte the ruled or lyned paper or papers vpon a playne, smooth, and stedfast table, where you shall stretche them forth, and make them fast with plomets or waightes, or nayle them to the table by the sydes and corners with small nayles. Then vpon the sayde ruled paper, you shall put the paper that is translated from the paterne, in that syde or parte that is correspondent from the paterne to the ruled Carde, so that the lines of East and West, North and South of the translation, may be vpon the lines that aunswere to them in the ruled carde.

This paper thus made faste by the one syde or parte, you shall by the other syde (that it maye remayne in his place) put vnder it another fine paper, smoked or smyzed on the nethermost parte (whiche is that that selleth vpon the ruled Carde) eyther with a lynke or with matches of pitche. These thus ordered and made faste one vpon another, you shall take a stiele bodkyn, or wyze with

Some do  
this only  
with oyle.

With a smoothe and blunt poynt. that it rase not oꝛ boze not the paper: and with it shall you drawe, pressing by The traſing  
of t. e Carde upon all the translation, and traceyng it with diligence and discretion, marking ever how much in it is translated from the paterne: saving the wyndes oꝛ lines which the Maryners call Rumbos, and so shall remayne all the impression of the smoke in the ruled Carde. Upon the which with a fine penne you shal trace with ynke: which beyng drye, you shall with crumbes of breade make it cleane from all the smoke, and so shall the coast appeare in the Carde drawn with ynke.

This done, then with a small penne shall you describe in the Carde all the places and names of the coast The paynt-  
ing of the  
Carde. in that part where they are, and as they are seene in the paterne. And fyrst you must describe in red, the portes, principall capes, famous Cities, with other notable thynges: and all the residue in blacke. Then shall you drawe oꝛ paynt Cities, Shyppes, banners, and beastes, and also marke the regions and other notable thynges. Then with colours and golde shall you garnyshe and beautifie the Cities, Compasses, Shyppes, and other partes of the Carde. Then shall you set forth the coastes with greene, by the shore oꝛ bankes of the landes, and make them sayre to syght with a lyttle saffron, oꝛ other wyse as shall seme beste. Lykelwyse shall you describe certen letters with theyr significations in this maner.

B. for a Bay. C. for a Cape. A. for an Angle. I. oꝛ M. for an Ilande. P. for a Pountayne. P. for a Port. R. for a Ryuer.

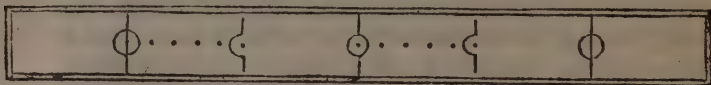
Then in place where is more roome, oꝛ that is least occupied, you shall drawe two ryght lynes equalye distant: and the one no further from the other then halfe a synger oꝛ lyttle more, and so longe, that betwene theym maye bee marked at the leasse three hundreth leagues. And this the Maryners call the truncke oꝛ scale of leagues, & place it oꝛ vse it in this maner. They take with the compasse a hundreth leagues of the truncke

The marking of the  
trunck oꝛ  
scale of the  
leagues.



The 3. part.

of the Carde or paterne that is translated. And they set them iuste betwene the two lines, and this space they part by the halfe, and reſte in. 50. And theſe deuided by the halfe, they reſte in. 25. And the, 25. beyng deuided, they reſte in. 12. leagues and a halfe. And marke them as appeareth in the demonstration folowynge.



The gradu-  
ation of the  
Carde.

The Carde beyng thus made, then to graduate it or de-  
uide it into degrees, you muſt drawe three lines, which  
make ryght angles with the line of Eaſt & Weſt, equi-  
diſtaunte to the line of North and South: and they alſo  
ſhalbe North and South. Theſe ſhalbe drawn by the  
Ilandes of Aſores or Soria, or nearer to Spaine, or wher  
the Carde ſhalbe leſſe occupied. And for this purpoſe,  
the one line muſt be ſo farre diſtant from the other, that  
in the two ſpaces which they make, may be marked, in  
the one the degrees, and in the other the number of the,  
conformable to the graduation of the paterne: as the  
numbers of degrees ſhelwe Eaſte and Weſte, with the  
portes, capes, and coaſtes in theyr proper altitudes.

And yf the carde haue no graduation, you ſhall take  
in the compaſſe of the trunke of the leagues, ſeuē ſpa-  
ces of. 12. leagues and a halfe, whiche are. 87. leagues &  
a halfe. And theſe muſte be deuided into five partes,  
which come ſooth at. 17. leagues and a halfe for a part.  
And the ſoure partes taken in the compaſſe, make ſoure  
degrees: and deuided into ſoure partes, every part is a  
degree, and is marked thus.  $\odot$

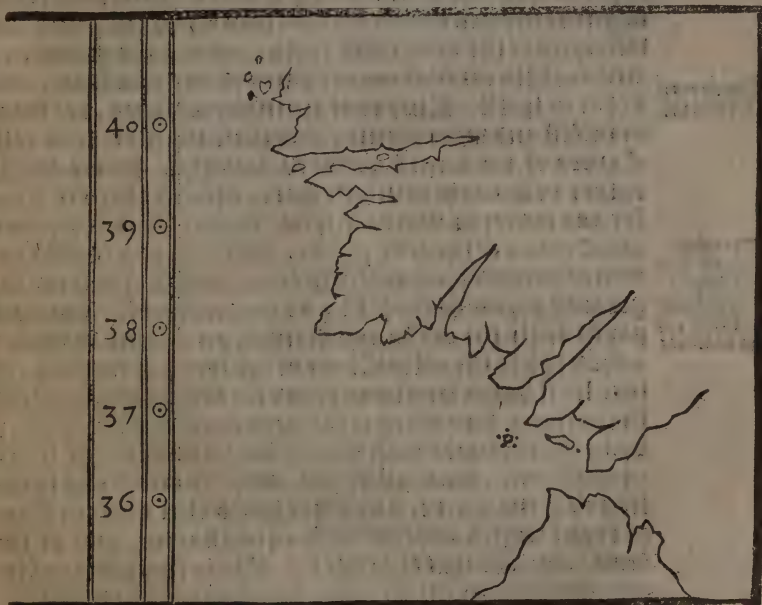
The marke  
of a degree.

And yf you wyl make the degrees at. 16. leagues & two  
terces or more: you ſhall geue to every degree ſo muche  
ſpace as the leagues comprehend. This graduation  
muſt be begun from ſome one cape, whoſe altitude of the  
Pole is wel known. And the whole Carde beyng thus  
graduate, you muſt begynne the number of the degrees  
from the Equinoctiall line, one, two, three. &c. toward  
the one Pole, and the lyke toward the other: ſo that  
to

to the known Cape maye aunswere the number of his altitude. And so shall you do to the whole Carde. Also the Equinoctiall line shalbe marked in his proper place. And in lyke maner shal you marke the Tropicke accordyng as they are in the Sphere. But forasmuche as in Spayne, Cape Saint Vincent is the pyncipal: they begynne there to make graduation, and number it in. 37. degrees. And from thence towarde the Pole Arctike, the degrees do increase. And from thence towarde the Equinoctiall line they demynyshe: and from that line to the pole Antartike they increase agayne (as we haue sayde) as is conteyned in the Carde, and as appeareth in this demonstration folowynge.

Cape saint  
Vincent.

Increasing  
and dimi-  
nyshing of  
the lines.



And yf the paterne haue neyther leagues noꝝ degrees, you must take oꝝ knowe the altitudes of two capes that are North and South, and the difference of the degrees

If the paterne haue neyther leagues neyꝝ degrees,



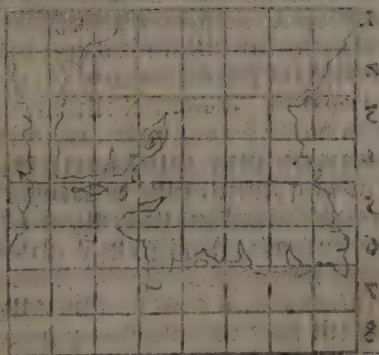
that is from the one raze to the other, by the whiche degrees they deuide the space of fyrtene leagues and a halfe for a degree. And accordyng to the opinion of the leagues of the roundnesse of the earth, as we haue sayde as touchyng this in the eightenth Chapter of the fyrst parte. In Spayne they vse with the compasse to take the space that is from Cape saynt Vincent, to the myddest of the greatestlande of Berlinga, which they accounte thre degrees: So that after fyrtene leagues and a halfe for a degree, they are. 52. leagues and a halfe. And so muche do they put in this space. Other put. 50. leagues accountyng after fyrtene leagues and two terces for a degree. And in this maner they make of leagues degrees, and of degrees leagues. The saylyng Cardes, haue no certain bygnesse limited them: because they onely represent the discriptio of the water and earth, and not the quantitie. And for this cause, some are paynted in great space, and other in lytle. They that are in greate space, are moze manifest and moze pzeise. And these the Mariners call Cardes of the largest prycke or draught. Some desyre rather to haue them in lesse space, because they are briefer and conteyne muche in lytle rounne. And these they call Cardes of the lesse prycke. And if for any consideration afore sayde, you desyre to reduce any Carde from the greatest prycke to the lesse, or contrary wyle: you must paynt onely the coaste and landes on a paper in maner as you dyd in the ruled Carde of the lynes or wyndes. I saye let it be drawen vpon paper for destroyng or rasing the paterne. And when it is traced onely with inke, then vpon that draught shall you drawe certayne ryght lynes equidistaunt, made all by one compasse accordyng to the length of the Carde. And other lynes that may cut them in ryght angles and lyke wyle equidistaunt, and of the same compasse that the fyrst are. These two orders of lynes, shall deuide all the superficiall parte of the Carde into perfect squares or quadratures. And it is to be noted that the nearer the lynes are soynd together, and the squares the lesse, so muche the moze perfectly may it be reduced, and moze easely. Then shall you take an other paper

The quantitie of Cardes

The reducing of Cardes from a bygge forme to a lesse, or the contrary

paper greater or lesse then the Carde, according to the  
 poynt that you desyre to reduce it unto. And in the length  
 and breadth thereof, you shall deuyde so many spaces as  
 are betwene the lynes of the other paper. And if it be  
 greater, the squares shalbe greater: and if lesse, lesse.  
 To kepe order in the correspondance of the squares (which  
 shalbe a great lyght to translate the one from the other)  
 you shall number the orders of the squares) as those of  
 the longitude, by the fronte or bypermost part: and those  
 of the latitude, by the syde, as well in the one paper as in  
 the other, conformable. Also those of the fronte, from the  
 lefte hande to the ryght. And those of the syde, from above  
 downwarde. Then beholde the coast howe it goeth by  
 the squares of the fyrst paper. And likewise the traceing  
 or drawyng in the squares of the seconde, in the selfsame  
 order and proportion as it is there. And so shall it re-

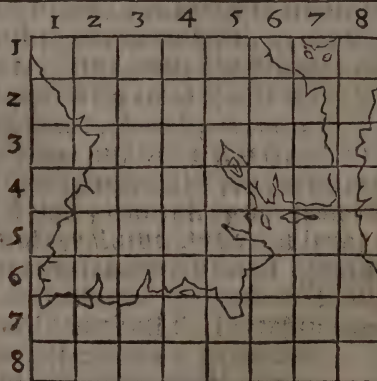
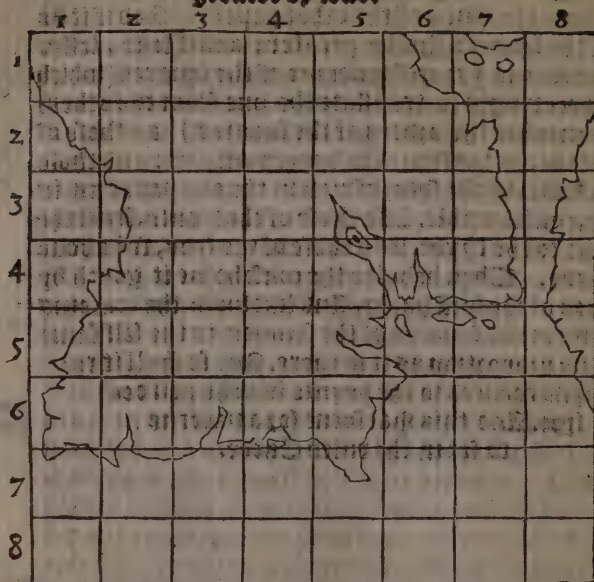
mayne reduced to the poynte whiche you de-  
 syre. And this shal serue for a paterne  
 to set in the ruled Carde.



1769 oct 10 12 11 10 9 8 7 6 5 4 3 2 1  
 10 9 8 7 6 5 4 3 2 1



**H**ere foloweth the maner of translatyng the  
Carde from one fourme into another  
greater or lesse.



**H**ere foloweth a similitude of the Mary-  
ners Carde.

The Pilottes and Maryners neyther vse nor haue the knowledge to vse other Cardes then only these that are playne, as I haue sayde. The which, because they are not globous, sphericall, or rounde, are imperfecte, and fayne to shewe the true distaunces. For in howe muche they depart from the Equinoctiall toward which soeuer of the Poles, the Meridian lines are contrate narrower and narrower: In suche maner, that yf two Cities or poyntes in the Equinoctiall, shoulde be distaunt of longitude, 60. leagues, and in the selfe same Meridians at 60. degrees from the Equinoctiall toward epyther of the Poles, shoulde be other two Cities or poyntes, they shoulde be distaunt in longitude but onely. 30. leagues. And so the better declaration and vnderstandyng hereof, I say that yf two shippes shoulde depart from the Equinoctiall, the one distaunt from the other a hundreth leagues by East and Weste, and that epyther of them shoulde sayle directly by his Meridian toward the North: then when epyther of them hath the Pole ouer his Horizon, 60. degrees, the one shalbe distaunt from the other only. 50. leagues by the paralelle of East and West: as appeareth by the plaine Cardes, that they haue the selfe same hundreth leagues. And beside these considerations, one errour byngeth in an other: and so an other another. Wherof to speake any more here, it shalbe to certain Pilottes (as the Proverbe saith) not onely to geue musicke to the deafe, or to paynt a house for bynd men, but shal also be an endlesse confusion. Furthermore it is necessary to consider, that good Cardes ought to haue the Coastes, Portes, Cities, & other places, situate accordyng to the wyndes or lines therof, proportionally as they are in the world: and not by the wyndes that the compasse sheweth. This I say for the Northeasting or Northwestyng of the compasse (called the variation) as hereafter I wyll touche in the. v. Chapter. And lykelysse shall you diligently obserue that the graduation of the Carde shewe the same in theyr proper altitudes. The Cardes that lacke this, ought to be corrected

The playne  
cardes are  
imperfecte

Example of  
errours in the  
plaine Cardes.

The ignorance of  
certaine Physicists.

Good Cardes.

The variation of the  
compass.

Altitudes.



In the narrow  
seas  
they sayle  
not by the  
elevation of  
the pole.

In the narrow  
seas  
they sayle  
not by the  
elevation of  
the pole.

Corrected of  
the sea card.

The West  
Indies.

Charles the  
Sixth.

fed and amended by wyse and experie men: Sauninge  
that in the Leuant sea (called Maré Méditerranéum) and  
in the Chanell of Flaunders (called the narrow seas) it  
is not inconuenient for the nauigation, that the portes  
be marked in the Cardes by the wyndes, whiche the  
compasse sheweth: soasmuche as they sayle not by the  
altitudes of the Pole: Lyke wyse it shall not be incon-  
uenient, but rather very necessary (to auoyde so manye  
errours, of the whiche do flowe great daungours and  
such a confusion) that your Maiestie shoulde commaunde  
certain learned Cosmographers, and experie in the arte  
of sayling, to verifie the altitudes of the Pole, that are  
of Portes, Capes, Ilandes, and people by the coastes  
of the Sea. And in lyke maner truely to describe the  
coastes of the lande: Especiall ye of the nauigation of  
the West Indies or Mundo Nuevo, where it hath pleas-  
ed God that so many nations and people haue receaued  
the water of holy baptisme, comming to the knowledge  
of the true God: whereby the Chrysitan Empparis  
greatly amplified, besyde the greates riches had by the  
sayd Indies. And this hath God miraculously wrought  
by the conquestes of your Maiestie, in subduyng Infy-  
dels and Gentyles to the obedience of the true Catho-  
lyke sayth. Wherby not only God hath ben well pleas-  
ed, but also your Maiestie hath receaued perpetuall  
fame, with eternall renowne and immortall glorie to  
your posteritie in woordes to come.

### **C**The. iii. Chapter of the vertue

and propertye of the Lode stone, called  
in Latin Magnes, and  
in Spanyshe Pi-  
cedrayman.

The



The Lode Stone (as wyrteth Cardinall Cusanus) hath substance, vertue, and operation. His vertue is engendred of his substance, essence, or being.

The dectus substance, & operation of the Lode Stone.

And of his essence and vertue proceedeth his operation and effecte: In such sorte, that this stone communicatynge his vertue to iron, by reason thereof,

causeth the iron to moue, although betwene the one and the other be a cuppe or plate of Syluer, or a table, or any other lyke thyng.

The attractyue or drawyng force of the Lode stone, causeth the nature of Iron to be and rest in it: And that so firmly and quietly, that beyng naturallie heauye and ponderous, it descendeth not, because his nature resteth not in hym selfe, but is vnite with the nature of the stone, which seemeth to extende it selfe, and as it were to caste forth a liuely spirite of enchauntynge vertue. Insomuche that (as we see by experience) by the sayde vnion, it not onely distributeth his vertue to one Iron, but that Iron likewise to another, and that other agayne to another: and so forth, vntyll of many rynges or lynkes of Iron be made a chayne.

Vertue attractiue.

Cusan applieth this to the glorified bodye of Christ, according to these wordes. If I shalbe exalted, I wyl draw all vnto me.

Saint Augustine (as he wyrteth in his booke De Ciuitate Dei) dyd maruaile that he sawe an Iron moue it selfe vppon a vessell, by mouynge the Lode stone vnder the vessell.

It is called Magnes, because the inuentour or fynder therof was so named: Whose (as Plinie wyrteth) keepynge cattayll in East India, had his shoes soled with plates of Iron, and Iron nayles, such as they vse in Gasconie, and had in his hand a staffe with a pyke or hooke of Iron. And resting hym selfe vppon a quantitie of this stone, coulde not remoue his feete, neither lyfte vp his staffe.

Why the Lode stone was called Magnes, & the fyndynge therof.

Then stayynge a while astonysed, as ignoraunte of the cause, at the length began to perceauie the proprietie of the stone, & to vnderstande the attractiue vertue thereof. The coloure of it differeth not from Iron.

And



Sendre  
kyndes of  
the lode stone

The lode stone  
of Spain

The lode stone  
of Elua.

The lode stone  
of Denmark.

The lode stone  
of Ethiopia.

Diuers opinions  
of the lode stone.

The qualities  
and properties  
of the lode stone.

The partes  
of the lode  
stone.

What part  
of the stone  
answereth to  
the North &  
South.

And was therefore called quicke Iron or luyng Iron. The beste kynde of these stones, is of Azurine or blew colour, as the Sea sometymes appeareth. Of these are founde fyue kyndes or differences. The first is of Ethiopie. The seconde of Macedonie. The thyrde of Lechio in Boecia. The fourth of Troade neare to Alexandria: And the fifth of Asia. But at this day, it is found in diuers other places. It is founde also in many places in Spayne: As in the hyll Morena neare vnto the village of Calera, beyng of the order of saint James in the prouince of Leon. Lykelwyse in a hyll of Moron in the territozie of the Erle of Vrenia is great quantitie therof, & in diuers other places. The stone that we moste commonly vse, is of the Iland of Elua of the Lorde of Pomblin: whiche I iudge to be better then that of Denmarke. This and the other, haue vertue to drawe iron vnto them. And trewe it is that Teanxedes wyrteth: That in Ethiopie is founde an other kynde of this stone, that putteth iron from it. Aueroes the commentator of Aristotle, denieth that Magnes draweth iron vnto it. But sayth that iron by his naturall inclination, doth moue to the stone as to his naturall place, by a certayne qualitie which the stone impresseth in iron. And besyde this vertue and propertie that it hath to drawe iron vnto it, it hath also an other. And that is, that it geneth vnto iron vertue and powre to shewe the two pointes of the Horizon where it cutteth the Meridian, that is in the two wyndes of North and Southe. These vertues are found more intent in only two partes of the stone. And these are euer opposite or contrarie the one to the other. And so are they contrarie in operation. For iron touched with the one parte, and placed where it maye moue frely, wyl shewe the North. And an other iron touched with the other parte, wil shewe the South. Fyndyng this experience, may be knowen what part of the stone aunswereth to the North: which the Mariners call the face of the stone: And lykelwyse of the Southe. This stone is so necessarye, that without it, Navigation shoulde bee imperfecte and vncertayne.

Because

because it geueth lyfe to the needle and compasse which leabeth and guydeth the Pilotte that he may go certenly in the day, and not erre or wander in the nyght. Also it sheweth and directeth to compasse the worlde, and to knowe the wyndes. And therfore, forasmuch as the compasse is so necessary, we entende to shewe the order and maner howe it ought to be made. For it may chaunce to sayle or be lost in the biage.

The use of  
making of  
the compass  
here comes  
passe.

### **C**The.iiii. Chapter, of the making of the Maryners compasse for Nauigation.



Take such past of paper wherof Cardes are made. And make in it a circle, of the quantitie of a spanne, or lyttle more or lesse. In the which you shall paynt the. 32. wyndes with theyr coloures, in suche order as we gaue in the fyrst and seconde Chapiture of the wyndes, and of the Carde: For forgettyng to mark the North with a floure deluce, and the East with a crosse. And more then this may euery man garnyshe and beautifie the same as seemeth best to his phantasie. The on the lower or nether part of this paste, you must draw a line which shalbe directly vnder that of the North and South: whiche shalbe the marke for the settinge of the Irens and Stieles. When shall you take wyze of iren or sticle of the byggenesse of a great pinne, or accordyng to the byggenesse of the roundenes of the paste, floure, rose or flye, as it may be called. This wyze muste be bothe double, so that euery of the partes maye be equallye as longe as the Diameter of the flye, and a quarter parte more. The endes or poyntes of these irens or stieles, muste be pinched together & made close, and open in the myddest the one from the other, vntyll the endes come to be equall with the extremities of the Diameter of the flye. And so shal the stieles remayne in maner in fourme of an egge. These wyzes or irens must be made fast in  
the

The floure  
deluce and  
the crosse.

The flye,  
floure or  
rose of the  
compasse.



*The. 3. part.*

*The line of  
North and  
South.*

*The touchyng of the  
needie wit  
the lode stone*

*The breas-  
dyng of the  
stone to  
drawe out  
his vertue.*

the nether parte of the flye : so that their extremitie, endes, or poyntes, come precisely by the line of North and South. And to fixe or fasten them so, they muste be couered with a thynne paper glued, leauynge the poyntes and endes vncouered. And these endes muste be touched with the lode stone in this maner. The parte that is vnder the floure deluce, muste be rubbed on that parte of the stone that aunswereth to the North, as is sayde in the Chapiter before. And this shall suffice for the perfection of the compasse. Yet some there be that for superabundance do touche the other part of the iron with that part of the stone that answereth to the south, although it maye suffice to touche it onely with the other parte. This touchyng of the iron with the stone, that the demonstratiue or woorkyng vertue maye shewe it selfe forth, must be done with geuyng certain strokes with a hammer on that part of the stone wherewith the iron muste be touched: That is to saye, in the North parte or the South. And from these wyll come forth of the stone certen beardes lyke small pycles, wheron you shall rubbe the poynte of the iron as you wolde whette a knyfe: And so shall certen of those beardes of the stone cleaue and sticke faste to the iron. And the irons thus touched with the beardes cleauyng to them, you must take a prycke or poynt of laton, of pyramidall sharpe, or steeple fourme, whiche is brode belowe and sharpe aboue towarde the poynt. This is made rounde or eight square, as seemeth beste. And in the nether parte or breadth, it must be bozed (but not thozough) with a bozer which must also be of pyramidall fourme, and enter into the myddeste of the sayde pyramidall prycke or poynte of laton, vnto the myddest, or somewhat more. This pyramidall poynt (which the Maryners call the Capytell) must be of heyght halfe a finger breadth, or accordynge as the compasse shall be, and muste be put through the center of the flye, so that the poynte come forth on the hygher parte thereof, and muste there be made faste and well

well firte. When shall you take a rounde bore of wood, within the whiche the needle maye be, not touchynge the sydes of the same: And this must be of the heygth of the halfe Diameter of the compasse. And the grounde or bottome therof muste be sette to it, as the couerynge of a bore, that it maye be easely taken of and put on, to haue often recourse to touche the Irons with the Stone (whiche they call feedyng) when neede shalbe, that the vertue of the compasse sayle not. Also in the myddest of the grounde or floore of the bore, you must set a sharpe poynt or pricke made of a wyre of laton: This muste stande ryght vp. And vpon the pricke or poynte thereof, you shall sette the bozed hole of the Capitell. And that the wynd enter not aboue, you shall couer the bore with a glasse. And thus beyng touched with the stone and set vpon the poynte, it shall shewe the true parte of the South, and consequentelye all the other wyndes.

The bore of  
the compasse

Featyng the  
needle with  
the Stone.

And here is to be noted, that after the irons or needle of the compasse hath ben touched in anye of these maners, yf you bryng the South parte of the stone to the South of the needle or compasse: then wyll the South of the needle come to it. And yf you bryng the South parte of the stone to the South parte of the needle, it wyll flee from it.

A notable ex-  
perience of  
the Lode  
Stone.

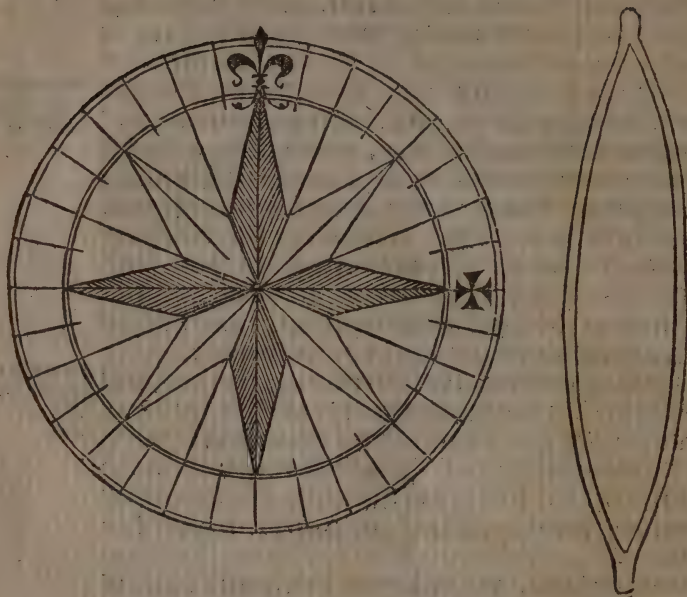
And contrarywyse, yf you bryng the South parte of the stone to the South of the needle, it wyll come to it: and yf to the North, it wyll flee from it. This is vnderstande, the needle or compasse standynge as it shoulde be. And this also is a good signe to knowe whiche is the North parte and South parte of the stone.

Moreouer, this bore muste be putte within another bore, in the whiche it muste hange vpon two circles of laton, annexed the one within the other: whiche serue that the compasse waye not or hange not towarde the one syde or the other, althoughe the shyppe swaye. And this bore also muste haue his couer of woodde, to kepe the other. You shall lykwylse obserue that the poynte of the Capitell and the hole thereof, and also the point or pricke vpon the which it resteth, be vpryght,

and



and lykelwyle the Rose, that it decline not to one parte  
o2 other. And yf it be quicker then it ought to be, then  
make the poynt that it goeth vpon somewhat blunter.



# **C The. v. Chapter, of the effecte**

o2 proprietie that the compasse hath to

Northeastynge, o2 Northwesting

wherby is knowen the

variation of the

compasse.

The variati  
on of the  
compasse



Any and diuers are the opinions that  
I haue harde, and also read in certein  
wyters of later dayes, as touchynge  
the Northeastynge, and Northwesting  
of the compasse. And yet mee see-  
meth that none doeth touche the  
pycke, and felwe the whyte. They  
call it Northeastynge, when the  
needle

needle sheweth or poynteth from the North (whiche is his true marke) toward the North-east. And North-west, when from the North it declineth toward North-west. For the better understanding of these differences whereby the needles differ or varie from the Pole, you must (being in the Meridian where the compasses shew the pole) imagen a poynt vnder the pole of the worlde.

And this poynt to be without all the heauens conteyned vnder the fyrst mouable. The whiche poynt or parte of heauen, hath a vertue attractiue that draweth vnto it iren touched with the parte of the lode stone correspondent to that, certayne parte of heauen imagined without or vnder all the heauens moued by the fyrst mouable. For if it were imagined to be moued within any of the moued heauens, then the attractiue poynte by the mouing of the fyrst mouable, and consequently the compass, should make the selfe same mouing in. 24. houres, whiche is neuer seene. And therfore, this poynt is not in the moueable heauens, neyther in the pole. For if it were in it, the compass should not varie North-easting or North-westing. Therfore the cause of North-easting and North-westing, or departing from the pole of the worlde, is, that being in the sayde Meridian, the attractiue poynt & the pole, are in the selfe same or in one Meridian: And the compass shewing the attractiue poynt, sheweth directly the pole. And departing from the same Meridian toward the East (the worlde being rounde) the pole of the worlde remaineth to vs on the left hande: And the point of the attractiue vertue, shalbe on the ryght hand, which is toward the North-east wynde. And in holwe muche more we shall sayle toward the East, the distaunce shall appeare greater vnto vs vntill we come vnto the. 90. degrees: And there shalbe the most and greatest North-easting. And passing from thence further forward, it shall appeare vnto vs that the attractiue poynt commeth nearer and nearer vnto the Meridian lyne: And so muche shal the compass go bettering or amending the North-easting, vntyll it returne to the selfe same Meridian in the opposite or contrarie parte from whence they came.

The poynte attractiue is imagined vnder the pole of the worlde.

The cause of the variatio of the compass.

Departinge of the pole fro the point attractiue.

The greatest North-easting.



The greatest  
Northwest-  
ring.

The attrac-  
tive poynit is  
vnder the  
pole.

The North-  
eastinge and  
Northwest-  
ting is not  
vniforme.

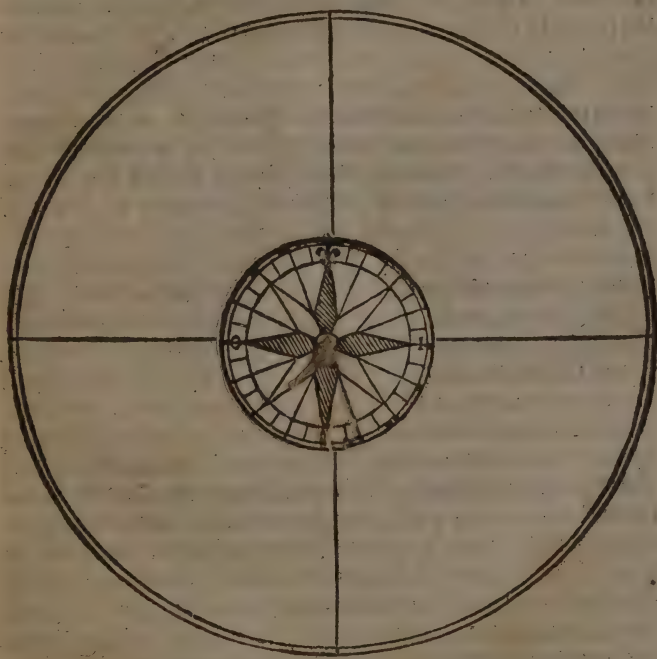
The declina-  
tion of the  
sunne.

02 where they began. And then shall the attractive point  
be to them directly vpon 02 against the pole of the world:  
And the compasse shall shewe 02 poynite directly toward  
it. And agayne passynge further forwarde, the pole of  
the worlde shall remayne to the ryght hande: and the  
poynite attractive to the lefte hande. And so shall the com-  
passe begynne Northwestyng, increasynge it vntyll it  
come from thence to the. 90. degrees: and there shall be  
the moste of his Northwestyng. For tournyng towarde  
the Meridian from the attractive poynit, it shall go amē-  
dyng 02 betteryng vntyll it retourne to the selfe same  
Meridian from whence it departed. And there shall the  
compasse shewe the pole of the worlde directly by 02 ouer  
against the attractive poynite, whiche is perpendicularly  
vnder the pole. And if from thence they should tourne to  
passe towarde the West, the pole should rest to the right  
hande, and the attractive poynit to the lefte: And so shall  
the variatio be to the Northeast. And this is the cause of  
the Northeastyng and Northwestyng, 02 variatio of the  
compasse. Also it is not to be vnderstode that this north-  
eastyng and Northwestyng is vniforme as is the depar-  
tyng (02 according to the departure) from the Meridian  
where the compasse sheweth perfectly: but rather befoze  
at the begynnynge of the departing from the sayde Peri-  
dian, it maketh difference 02 variation in a certayn qua-  
tite. And the increase that is afterwarde, is little: And  
so muche the lesse, in howe muche the moze the departing  
is from the sayd Meridian. For it is a passion of circles  
deuidyng 02 cutting them selues in the sphere. So that  
these differences are, as are they of the declinations of  
the Sunne: Whiche neare vnto the Equinoctials, are  
great, & neare to the Solstitials, are little. All the which  
shall euidently appeare in the figure folowynge: which is  
a circle deuided by two Diameters into foure equal par-  
tes, cutting them selues in the center in ryght angles.  
And from the center poynit (called the pole) cometh forth  
a moueable Meridian. And in it goeth a compasse lyke-  
wyse moueable about the circle. The attractive poynit is  
some what distaunt from the pole of the worlde. And fro  
it, cometh

it, cometh forth a threde whiche must euer passe by the North and South of the compasse. And the compasse being in the Meridian of the point attractiue that passeth by the pole, shall shewe the pole. And without that, shal go Northeastynge or Northwestynge, so varyng and departing from the true Meridian that cometh forth of the pole of the worlde. It is the opinion of some mariners, that the Meridian where the compasse sheweth directly the pole, passeth by the Iland of Sancta Maria. And other saye, by the Ilande of Cuerno in the Afores.

The meridian that sheweth the pole.

¶ Demonstration of Northeasting.



And where as the inconuenience is manifest & notorious, the same must be remedied with prudence & tyare: And not to be neglygent in the viage. But euer to vse and obserue experience, more profytable then the subtile

Experience the grounds of reason.



Advertises  
mente to  
Pilottes.

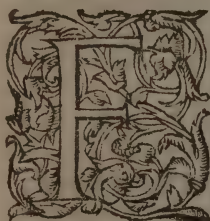
Example of  
sayling.

The varia-  
tion of the  
compasse.

and curious questions of the secrete searchers of natural  
thynges without experience, whercof reason taketh his  
principall ground. And therfore the wyle Pilotte ought  
to knowe by experience (as many of them doe not) howe  
muche a good cōpasse doth varie Northeast or North-  
westyng from one port to an other. So that to knowe  
howe muche the compasse doth varie, Northeastyng or  
Northwestyng from one place to an other (as to saye,  
halfe a quarter or moze or lesse in quantitie as they are  
distaunt from the sayde Meridian where the compasses  
shewe the pole) shall in the nauigatio take heede and wel  
consyder, in any such viage, the Northeast or North-  
westyng in the poyntes of the compasse. And this shalbe  
to saye truely by the poyntes or lynes that the Carde  
doth certaynly shewe. As for example: In sayling from  
any Ilande that is in the sayde Meridian, or from anye  
other parte, in seeking of any porte that is to them true  
Northeast, yf by this way the Cōpasse should Northeast  
halfe a quarter, then sayling by the poyntes or lynes of  
the Compasse Northeast halfe a quarter to the North,  
their nauigation shalbe (excepting other impedimētes)  
to the Northeast whiche the Carde sheweth. And by this  
poynt or lyne, must be made the accounte of such a viage.  
And so by the poyntes of the Carde, they shall directlve  
fynde the porte that they sought. And by this order shall  
they gouerne them selues in all nauigations. For the  
whiche, it is conuenient that wyle and experte Pylottes  
should make notes of obseruations of Northeast and  
Northwestyng, that is from porte to porte. And to make  
compilations and gatherynges of suche notes to carpe  
with them in their shippes for regementes. And not to  
be to busie or curious to amende their Cōpasses, or with  
the stone to rubbe the irons or stieles neyther on the one  
syde or the other, from whence the flower deluce doeth  
shewe: For this should cause many inconueniēces. Nei-  
ther ought they to admitte in their Cardes two gradua-  
tions: Especially for that to knowe howe muche in euery  
place the Compasse doth go asyde or varie from the true  
Meridian, may easely be made an instrument to shewe  
the same

the same by the Sunne in the daye, and by the starres in the nyght,

## The. vi. Chapter of the introduction and principles of the Arte of Nauigation.



As as muche as nowe we haue the guide, whiche is the compasse, it is conuenient to enter into the waye: which is Nauigation. The which (as we haue sayde) is to go or passe by water from one place to an other. And this presupposed, I saye that he that desyeth to attempte Nauigations, muste knowe

two thynges whiche the Carde shal shew hym. The one is, by what point or lyne he ought to sayle. And this, shal the lynnes of the saylyng Carde shewe him. The other is, the leagues of the distaunce: And this shal the scale or trunke of the leagues shewe. Takyng with a compasse the distaunce of two places, and applying it to the scale. The knowledge of these two thynges, ought the Pylote to beare in memory. And to put them in effecte, ought to directe his foreshyppe to the selfe same wynde which the compasse doeth shewe. For the distaunce, he ought to knowe howe muche the shyppe goeth dayly: well considering and obseruing the wynde, tydes, currentes, and all suche thynges as may be with hym or against hym. And accordyng hereunto, he shal knowe howe muche he hath gone, and what remayneth for hym to go: and whether he be farre of or neare vnto the place whyther he intende to sayle: The whiche in nauigation, is the ende desyred. And because this estimation or computation can not be iust and exacte, especially in a long viage or in long tyme, it shalbe conuenient that we rectifie or amende it, knowyng the place where the shyp is on the superficiall parte of the water, by the place that aunswereth to it in heauen. This place of heauen, is knowen by the altitude of the pole. And by the altitude of the pole, is knowen

In nauigation what is chiefly to be considered.

The distaunce

The altitude of the pole and Equinoctiall.



The meere:  
on altitude.

To knowe  
the place of  
heauen.

To knowe the  
waye of the  
viage.

Rules to  
knowe the al-  
titudes.

Longitude &  
latitude.

Variation of  
degrees.

altitude of the Equinoctiall. And by the altitude of the Equinoctiall and declination of the Sunne, is knowen the Meridian altitude. And contrarye wyse, knowynge the Meridian altitude and declination of the Sunne, is knowen the altitude of the Equinoctiall: and by the Equinoctiall the pole: and by the altitude of the pole, is knowen the latitude. And this is the place that is despyed to be knowen. But for as muche as the heauen is moueable from the East to the West, this place is not knowen as a certen poynte. But is knowen as a lyne or paralele at a certen distance from the Equinoctiall. And it is not knowen in what poynt of this paralele the Shyppe is, by the altitudes that are taken from heauen: But it is knowen by the line that the Shyp hath gone, as we wyll further declare in the xiii. Chapter of making a poynte or picke in the Carde. And in this maner you shall haue rectified the waye that the Shyppe hath gone: and consequently the waye that it hath yet to goe.

And for as much as these altitudes are so profitable and necessary, it shalbe nedefull to gyue rules howe we may vse them to our moſte commoditie. And for this, is presupposed to know, that all places situate on the superficiall parte of the earth and water, either they are vnder one Meridian, so that they haue, or where they haue one selfe same longitude, and differ in latitude, or are in one paralele where they haue one self same latitude, and differ in longitude: or are in diuers Meridians and paraleles where they differ in longitude and latitude. And I saye, that if they haue one self same longitude, they sayle from the one to the other by the lyne of North & South. And howe many degrees doth varpe the altitude of the pole, and of the Equinoctiall in heauen, so many degrees haue they gonne by Sea or by lande. If two places haue one selfe same latitude, they passe from the one to the other by the lyne of East and West. And in suche maner of viage, the altitudes do not profite vs, because there is no variation. If they dyffer or varie in longitude and latitude, they sayle from the one to the other by some of the other lynes. But there are moze degrees that correspond

responde to the waye that the Gyppie maketh, then the degrees that varie the altitudes of the Equinoctial & the pole. And this difference shalbe greater, in howe muche the lyne shall dꝛawe neare to East and West. And howe muche it shall dꝛawe neare to North and South, it shall be lesse. Of the degrees, or leagues that aunswere to every degree of the variation of the altitude, we wyl entreate hereafter in the. vii. Chapter.

These altitudes are knowne many wayes: but especially by two: As, by the Meridian altitude and declination of the Sunne (as we haue sayde) is knowne the altitude of the Equinoctial: and by it, the altitude of the pole. The seconde waye, they are knowne by the altitude of some fyfte starre of those that are not hydde. And among many other, the North Starre is taken because it is nearest to the pole. To knowe the altitudes by the Sunne, thre thynges are necessary. That is to saye, an instrument, the declination of the Sunne, and rules.

Howe the altitudes are knowne.

The fyfte starres.

The North starre.

To knowe the altitudes by the sunne

The instrument to knowe the Meridian altitude, shalbe the Astrolabe because it is moste commodious for this purpose: whereof we wyl intreate in the Chapter following. The declination of the Sunne, (whiche is to take it away, or to ioine it with the Meridian altitude,) we haue already described in the thyrde Chapter of the seconde parte. The rules to knowe when the declinations must be ioined with the Meridian altitude, or taken from it, we wyl geue in the. viii. Chapter. To knowe the altitudes of the pole by the altitudes of the North starre two thynges are necessary. That is: an instrument and rules.

The meridian altitude.

The declination of the sunne.

The altitudes of the pole.

The instrument wherewith the Mariners are accustomed to take the altitudes of the North starre, they call Ballestia: whiche is a crosse staffe, wherof we wyl wyte hereafter in the nyynth Chapter. And the rules

Jacobs staffe

of the tourne or compasse whiche the North

starre maketh about the pole, we

wyl declare in the tenth

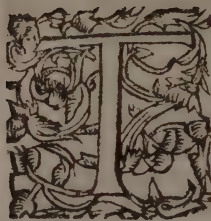
Chapter.

I. liii.

The



# **C**The. vii. Chapiter of the makynge and vse of the Astrolabie, with the whiche the Mariners take the altitudes of the Sunne.



Take a plate of copper or laton (whiche  
for this purpose is better then any o-  
ther metall) of the bygnesse that you  
desyre to make the Astrolabie. And is  
commonly of the bygnesse of a spanne  
the Diameter. And let it be of the thic-  
nesse of half a finger at the least: For  
the weightier that it shalbe, so muche

shall it be more steddie to take the altitude. This plate  
must be made rounde by a cyrcle, leauing comyng forth  
of the circle, a corner in the whiche you shall put a ryng  
or handle with a hole wherby you may hange the Astro-  
labie by a threede or lyne to take the altitude. After it is  
thus made with the ryng or handle annered therto, make  
it byght and smothe polished on both sydes, and all of  
one equall thyckenesse that one syde be not heuier then  
an other: whiche you shall trie in this maner. Hange the  
plate by the ryng or hole that you haue made: And from  
the same hole, hange a plomet of leade fastened to a beare  
or syne threede of sylke. The Astrolabie thus hangynge  
free and at libertie with the plomet, if then the threede  
fall vpon the center of the Astrolabie, it is well. But yf  
the threede do leane or swarue to the one syde or the o-  
ther from the center, then is that syde thicker and heuier  
then the other: and must therfore be made thynner untill  
the threede fall iustly vpon the center. This done, make  
a circle vpon the sayde center, a little within the circum-  
ference of the Astrolabie. Then drawe a Diameter fro  
the center of the hole in the which the ryng or handle is,  
vnto the center of the Astrolabie, trauersing or overth-  
warting the hole circle. And this shalbe called the lyne  
of the Zenith or verticall poynt: whiche also shalbe cutte  
with an other Diameter vpon the center, makynge right  
lynys with it. And this Diameter shalbe called the Ho-  
rizon.

The rectify-  
ing of the  
Astrolabie.

The threede  
& plomet.

The lynes  
vertical and  
horizontall.

horizontal lyne. These two Diameters shall deuide the  
 cyrcle into foure equall partes. After this, you shall make  
 an other circle so muche moze within the second, that be-  
 twene the circumferences of both the circles, may be co-  
 teyned the numbers of the degrees. Then (the Astrola-  
 bie hangyng befoze you) you shall deuide the one parte  
 (being the superioz and left parte) fyrst into thzee equall  
 partes. And euery part shall conteyne .30. degrees. Then  
 shall you deuide euery parte of these into other thzee e-  
 quall partes. And they shall conteyne ten degrees. And  
 euery of these deuide into two partes, and they shall con-  
 teyne fyue degrees. This done, put a ruler vpon the cen-  
 ter of the Astrolabie, applying it to euery of the poyntes  
 that deuide the sayde partes. And drawe certayne lynes  
 that passe from the circumference of the first circle vnto  
 the lesse circumference. And in the spaces of the lesse  
 cyrcle, wyte the numbers of the degrees: Begynnyng  
 in the Horizontall lyne. And in that space put fyue, and  
 in the seconde tenne, and so sooth of the other, vntyll  
 the .90. degrees ende in the lyne of the Zenith. Then  
 shall you deuide the spaces that are betwene the fyrste  
 Circle and the seconde, euery space into fyue, whiche  
 shall make the .90. degrees. The Astrolabie thus made,  
 you shall make the Alhidada or Labell. For the whiche,  
 you shall take a plate of laton of the bzeadth of scarcelye  
 two fyngers, and as thicke as the Astrolabie: also as  
 long as the Diameter of the Astrolabie. And make a line  
 in the myddest therof by the longitude. In the myddest  
 of this lyne, make a circle so great, that it may touche  
 in the sydes of the plate. Then cut of this plate on the one  
 syde, that that it hath from the lyne to the ryght hande:  
 And on the other syde, that that it hath from the lyne to  
 the leftte hande, leauyng the cyrcle whole. This line that  
 shall passe by the center of the cyrcle, is called Linea fidu-  
 cia (that is) the lyne of confidence: whiche is that that  
 sheweth in the degrees, the altitude that is taken. Then  
 shall you take away the endes or coznars of the Alhidada  
 that are without the line, so that you touche not the line.  
 This done, you shall make two lpttle rpsyng or rayssed  
 tablettes

The Myddes-  
 ta of the As-  
 trolabie.

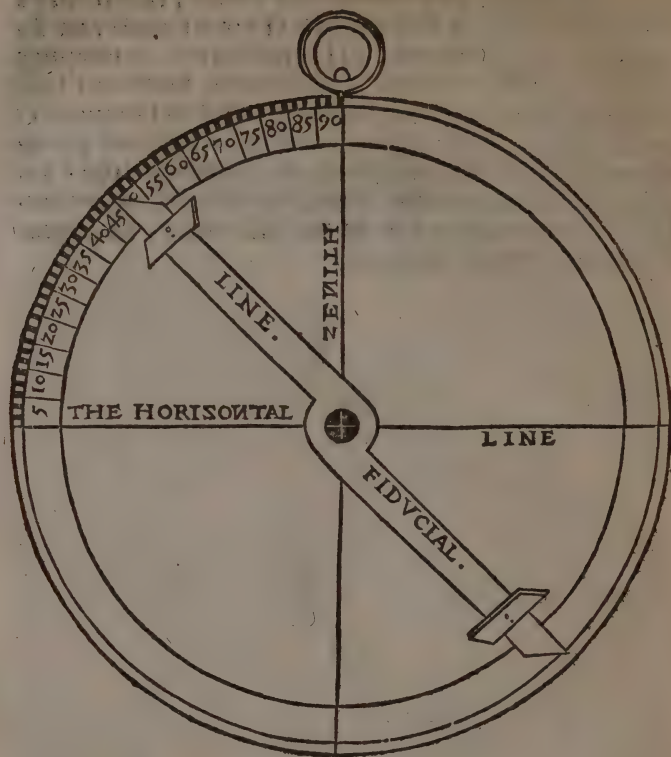


The holes of  
the Alhidada

tablettes or plates of the same metall wherof the Astro-  
labie is made, & of the selfe same thyecknesse that is the  
Alhidada, or little lesse: and of the bzeadth of the Diame-  
ter of the circle of the Alhidada. And let the be a thumbe  
in heygth or bzeadth. In the myddest of these two pla-  
tes by the height, you shall make a lyne. When these  
are made equall and al they angles ryght, in every line  
of these that you haue made, you shall also make two ho-  
les equally distant from the sydes or edges of the sayde  
plates or tablettes. And of the two holes of euery of  
these lytle plates, the one hole must be as bygge as may  
confeyne a great pynne. And these shall serue to take the  
altitude of the Starres. The other must be so subtil and  
small as a fyne sowynge neede: And these serue to take  
the altitude of the Sunne. They must be made in suche  
maner, that the outwarde parte of them be bygger, and  
lesse within, of the quantitie that I haue sayde. These  
tablettes or erected plates beyng thus made, they must  
be sothered in the Alhidada betweene the center and ex-  
tremities or endes of the same: makynge in it certen not-  
ches where they may be made faste and sothered. Or  
leauynge spys in the plates, certen sharpe poyntes or cor-  
ners that may enter into certen holes made in the Alhi-  
dada, wherby they may be made fast vnderneath wyth  
pyennes. And they must be so sette, that the lyne where  
the holes of the plates are, may fall vpon the lyne of con-  
fidence of the Alhidada. So that the one halfe of the plate  
be set vppon the Alhidada, and the other halfe without  
it or at large. In lyke maner shall you take good aduer-  
tisment that the great hole of y one plate, stand directly  
agaynst the great hole of the other plate, and be nothing  
at all awrye. This done, you shall boze the Astrolabie  
through by the center: makynge a very rounde hole that  
may haue in the myddest of it the center of the Astro-  
labie. This hole shall be of the bygnesse of a goose quyle.  
And the lyke shall you make in the center of the cyrcle  
of the Alhidada. Then shall you make a pynne or nayle  
of the same laton: The whiche on the vpper parte of the  
Alhidada maye haue a playne and rounde head. Thys  
pynne

pynne also shalbe very rounde and smoth, that it maye  
enter iuste and close into the hole of the Alhidada and As-  
trolabie. And at the ende or poynt thereof, commynge  
forth on the other syde of the Astrolabie, muste be a hole  
made syde waye thzough the pynne, close to the plate of  
the Astrolabie, of the bygnesse of a little nayle or pynne  
that may be put therein to make faste together the Alhi-  
dada with the Astrolabie, so that the Alhidada may ther-  
by be tourned rounde aboute the Astrolabie, as appea-  
reth in thys figure folowynge.





To take the  
altitude of  
the Sunne.

To take the altitude of the Sunne, hange by the Astrolabe by the rynges: and set the Alhidada against the Sunne. And rayse it or put it downe in the quarter that is graduate, vntyll the beames of the Sunne enter in by the lyttle hole of the tablet or raysted plate, and pprecysely by the other lyttle hole of the other tablet. Then looke vpon the lyne of confydence. And howe manye degrees it sheweth in the quarter that is graduate (begynnyng frō the Horizontall lyne) so many degrees of height hath the Sunne. In lyke maner shall you doe to take the altitude of any other Starre lookynge thozough the greate holes,

holes, because this may hardely be seene by the lyttle holes.

**The. viii. Chapter of the definition**  
of the Altitudes. And howe the Altitudes of the  
pole may well be knowen by the Peri-  
dian altitude and declination of  
the Sunne.



It is convenient to define the Altitude be-  
fore we geue rules of the vse therof. The  
Altitude of the Sunne or the Moone, or of  
any other Starre, is the distaunce that is  
betwene it & the Horizon. And this ought  
to be accompted by the degrees of the grea-  
ter cyrcle whiche passeth by the Zenith and by the cen-  
ter of the Sunne or of the Moone, or of the Starre vnto  
the Horizon. And the degrees that are from the Horizon  
to the Starre or to the Sunne, that is the Altitude: And  
the degrees that are from the center of the Starre or of  
the Sunne vnto the Zenith, is called the complement or  
supplement of the Altitude. The altitude of the equinocti-  
all, is euer counted by the Peridian. And the degrees  
of the Peridian that are betwene the Equinoctiall and  
the Horizon, is the altitude of the Equinoctiall. And o-  
ther so many, are they that are from the Zenith to the  
pole. For the Altitude of the Equinoctiall, is equall to  
the complement of the Altitude of the pole. The degrees  
of the Peridian that are betwene the Equinoctiall and  
the Zenith, is called the complement of the Altitude of  
the Equinoctiall: and is equal to the altitude of the pole.  
And although we haue defined the altitude in generall,  
yet shall we only profite our selues by the Peridional  
altitude of the Sunne. The Peridional altitude, is the  
greatest altitude that the Sunne hath euery daye. And  
this shalbe when the center of the Sunne is in the Peri-  
dian. And the arke of the Peridian that is betwene the  
Horizon and the Sunne, is the Peridian altitude. So  
that when we saye the altitude of the Sunne is taken, it  
is vnder-

what is the  
altitude of  
planetes or  
starres.

The comple-  
ment of alti-  
tude.

From the ze-  
nith to the  
pole.

The Verbis  
an altitude  
of the sunne.



The shadowes that the sunne maketh at myddaye.

is vnderstode at mydday. The shadowes that the Sunne the maketh, are in thre sortes. For either to vs it calleth the shadowe toward the North part, or toward the south, or perpendicular by a right vp lyne, so that at mydday or noone, nothing that standeth by righte, geueth any shadowe at all. But for as much as there is suche variation in declinations, altitudes, shadowes, and paraleles, it shalbe necessary to geue rules for all variations. And these shalbe reduced into foure bryefe and compendious rules: the whiche I haue here described that the wyttie may take profite by them, and the rude learne the: Not caring for the rules of the Mariners, because they are to long and tedious. For (as the Phylosopher sayeth) it is baynely done by many, that may well be done by fewe.

The perpendicular shadowe.

When the shadowe shalbe perpendicular, it is because the Sunne is in the Zenith, and, 90. degrees aboue the Horizon. And then how many degrees of declination the Sunne hath, so much shall we be distant from the Equinoctiall toward the parte where the Sunne declineth. And if it haue no declination, it and we shalbe vnder the Equinoctiall.

The declining shadowe.

When the Sunne and the shadowes shalbe to vs from the Equinoctiall toward one of the poles, we shal take away the declination from the Meridian altitude. And the complement for, 90. shall we be distant from the Equinoctiall toward the same pole.

When the Sunne declyneth from the Equinoctiall toward the one pole, and the shadowes shalbe toward the other, we shall ioyne the declynation with the Meridian altitude. And if all come not to, 90. then the complement for the, 90. shall we be distant from the Equinoctiall toward that pole to the whiche the shadowe falleth. And if they be mo in number then, 90. then the ouerplus of, 90. shall we be distant from the Equinoctiall toward the pole where the Sunne declyneth. And yf they be iust, 90. we shalbe vnder the Equinoctiall.

When the Sunne hath no declynation, we shalbe distant from the Equinoctiall the complement of the Meridian

dian

dian altitude towarde the pole where the shadowes are.

By these rules, besyde the vse wherof we haue spoken maye be knowen howe muche is the greatest declination of the Sunne, the altitude of the Equinoctiall, the daye, houre, & minute, when the Equinoctiall was: the whiche is knowen as foloweth.

Why the sun hath no declination.

Having taken the greater Meridian altitude of the spring (whiche is in the beginning of Cancer) & the lesse of wynter (whiche is in the beginning of Capricorne) takinge alwaye the lesse from the moze, the rest is that that is from Tropike to Tropike. And consequently parted by the myddest, is the greatest declination. As for example: Take the greater Meridian altitude from the beginning of Cancer in. 77. degrees: And the lesse from the beginning of Capricorne in. 30. degrees, takinge them out of the. 77. remaine. 47. degrees: and so muche is from Tropike to Tropike. And the halfe (whiche is. 23. and a halfe, is the greatest declination.

To knowe the greatest declination of the sunnes

Example.

Consequentlye the greater declination added to the lesse Meridian altitude, or takinge it alway from the greater Meridian altitude: that ysleth therof is the altitude of the Equinoctiall. Example. 23. and a halfe of the greatest declination, ioyned with. 30. of the least Meridian altitude, or taken alway from the. 77. of the greatest Meridian altitude: remaine. 53. degrees and a halfe, whiche is the altitude of the Equinoctiall in the cytie of Cadiz. Hereof it foloweth, that when we shall take the Meridian altitude in. 53. degrees and a halfe, that daye is the true Equinoctiall. But if one daye it had lesse, and the other daye folowynge it had moze, we must take the lesse from the moze, and fourme the rule of thre vppon the rest: saying. If the rest come to me of foure and twenty houres, then of those houres that shall come to me, that that lacketh of thre and fyftie and a halfe: that is the altitude of the Equinoctiall: And that that commeth therof, shall bee the houres of the Equinoctiall after myddaye.

Example.

The true or equinoctiall.

Exam.



Example.

Example of the experience that I made in the cytie of Cadiz the tenth day of Marche at mydday or hygh noone. I toke the altitude of the Sunne. in 53. degrees & 26. minutes: They lack to be the Equinoctiall. 4. minutes. Another day the .xi. of Marche, at noone, I toke the Sunne in. 53. degrees and. 50. minutes: whiche are more then the Equinoctiall by. 20. minutes. Then to knowe at what houre the Sunne was in the. 53. degrees and. 30. minutes of the Equinoctiall, I toke away the Meridian altitude that I tooke at the tenth of Marche, from that that I toke at the. xi. whiche is the difference. 24. minutes. And I formed the rule, saying: If. 24. minutes the Sunne dyd ryse to me in. 24. houres, then in howe muche tyme shall ryse vnto me the. 4. minutes that sayled me at the tenth of Marche? I multiplied, deuided, and founde that in foure houres: And so shal you say that the Equinoctiall was in the citie of Cadiz the tenth daye of Marche at foure of the clocke at after noone. Whiche is vnderstode (accozdyng to the Astronomers) at foure houres runne at the. xi. daye of Marche of this present yeare 1545.

### The. ix. Chapter of the making of the Crosse staffe wherewith the Mariners take the Altitude of the North Starre.



Make a square staffe or yarde of the thynnesse of a synger, more or lesse accoꝝdyng to the goodnesse of the wood: And of length fyve spannes or more. For the longer that it is, the more pꝛecise shal it be, and the degrees shalbe y greater, whereby foloweth the certayntie of the altitude. Then take a very playne table of the lengthe of the staffe, and two spannes of breath, or at the least a spanne and a halfe: And in the myddest of this table, make a ryght lyne by longitude, and in the one ende of this lyne, make an other line that may cut it in ryght angles. And vpon the cutting of these

two

two lines, put the foote of the compasse, and make halfe a circle which may remaine on the part of the long line, so that the halfe circle may haue so muche Diameter as you desire the heygth of the Hammer, head, or crosse-  
 piece of the staffe to be. This halfe circle beyng made, you shal drawe two lines equidistaunt to the line which you haue made by the myddest of the table. These lines must touche in the extremities or endes of the halfe circle. Then deuide euery halfe of the halfe circle or quarter of the circle into two equall partes: and the two halfes that shall ende in the fyrst line, deuide eche of the into. 90. equall partes. Then take a ruler, and put the edge therof vpon the center of the halfe circle, and vpon euery of the markes which deuide the. 90. partes: And so pproceede, makynge pundes in the lines whiche you haue made equidistant to the fyrste line. Then drawe certeine ryght lines from the pundes of the one line, to the opposite pundes of the other: & so shall the draught be ended. Then take the staffe or yarde, and put the one ende therof in the center of the halfe circle, and applye the edge of the yarde to the line that goeth by the myddest of the table: and marke in the yarde the markes that are in the sayde line, by meanes of the trauersyng lines. And see also that the markes whiche you make in the yarde, be trauersyng lines. And make them theyr numbers begynnynge at the ende or poynte of the yarde that shalbe to the contrary part from that which you did put in the punte of the halfe circle. And to knowe with what degrees you shall begyn the yarde or staffe, and what nūber you shal marke in the fyrst line of the punte: loke howe manye degrees are from the circle which you deuided betwene the line that goeth to the laste marke: and with so many degrees enter. And so consequentye shall you place the numbers from. 5. to. 5. or from. 10. to. 10. When you haue thus numbered the yarde, then to make the crossepiece thereof, take a table or planke of good wood, which shalbe so much in length as shalbe the Diameter of the halfe circle, and so much in breadth as thre tymes the thickenes of the yarde, and of thickenes.

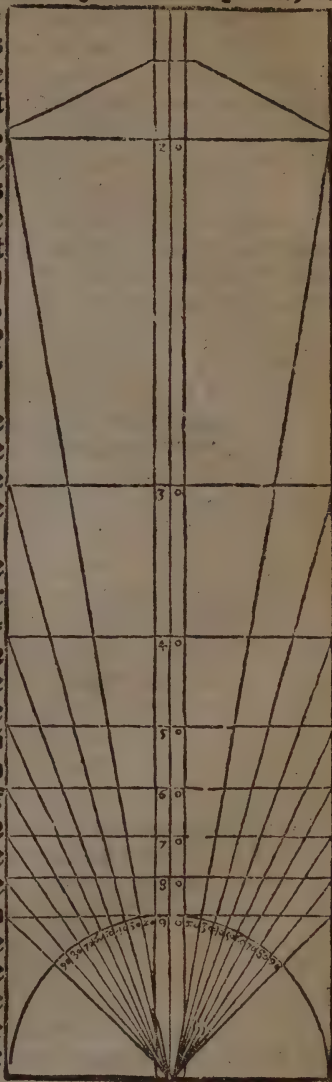


two fingers or lytle lesse. On the one syde also 't must be very playne, and on the other syde in the mydde, it must haue a square or quadrature of all the thickenes of the planke. And from the square to the endes, it must be made thinner & thinner, so that it haue in maner the fourme of suche pickeares wherewith myll stones are picked. And in the mydde (by longitude and latitude) it muste haue a square hole, by the which the yarde may enter iust, & make ryght angles with the crossepiece.

And the poynte of the yarde must enter by the plain side of the crossepiece, and come forth of the square syde therof.

To take the  
altitude of  
the Sunne.

To take the altitude of the North starre, or anye other starre on the Sea (soz it serueth not on the land noz for the Sunne, excepte yf the Sunne shalbe vnder anye thinne cloude, & the Horizō cleare) you shal put the head of the staffe to the corner of your eye, rayfing it vp, or putting it downe vntyl the nether part of the crossepiece come with the Horizō. And being so, if the higher parte of the crossepiece shal come with the starre, you muste looke the playne syde of the crossepiece in what number



of degrees of the staffe it falleth : and those degrees shal be the altitude of the starre. As yf the crossepiece reache not to the starre, you must bryng the crossepiece nearer to your eye, vntyl the one part therof come with the Horizon, and the other with the starre : and the degrees which it sheweth shal be the altitude.

**C** The. x. Chapter, of the Altitude of the Pole, knowen by the Altitude of the North starre.

**I** know the paralel in the which the shyp is, ouer and besyde the rules heare before of the altitudes of the Sunne : it is lykewise knowen by the altitudes of the North starre. These two maners are vsed, for that more credit is geuen to two witnesses then to one. So that yf by one aryse any doubt, the same may be certified by the other. And also because time may sometyne serue for the one and not for the other : As to haue a cloudy mydday or noone, and a cleare nyght.

The altitude is taken of the North starre : which is a starre in the extremitie or ende of the tayle of the lesse Beare, being a constellation comonly called the Horne. For this North starre (of the most notable starres about the Pole) is nearest vnto it, and shall therefore shewe a lesse circle then any of the other : and so shal his altitude dyffer lyttle from the altitude of the Pole. This starre hath declination. 87. degrees, and. 51. minutes. And the complement to. 90. (whiche are. 4. degrees and. 9. minutes) is his distaunce from the Pole. And although the Maryners holde opinion that it is not distaunt more then three degrees & a halfe: yet to my iudgement, more credit ought to be geuen to the Astronomers then to the Maryners : Forasmuch as the Astronomers do knowe the places of the starres, with their longitudes, latitudes, declinations and ryght ascensions, more perfectly & precisely then do the Maryners. For they account not onely by degrees, but also by minutes and secundes. But let none deceaue them selues through my opinion.

The North  
starre.  
The lesse  
beare.  
The horne.

The distaunce  
of the  
North starre  
from the  
Pole.



Therefore, whosoever wyll precysely knowe it, let hym take the hyghest altitude of the North Starre, whiche is his beyng ouer the Pole: and the lesse altitude, whiche is his beyng vnder it. Then take awaye the lesse from the more: and the halfe of that that remaineth, shal be the distaunce of that starre from the Pole of the worlde. And lyke wise by this experience may be knowen the altitude of the Pole, and what all the other starres that go not downe vnder the Horizon, be distaunt from it, ioyninge the greater altitude with the lesse: And that shal amount therof, deuided by the halfe, shal be the altitude of the Pole. And takynge awaye this altitude of the Pole, from the greater altitude of the starre, or the lesse from the altitude of the Pole: the rest that remaineth, shal be the distaunce of the starre from the Pole.

The Pole  
is inuisible

And as the Pole is inuisible, it can not be sene or knowen when the North starre is hygher or lower, excepte it be by the meane of some other marke. And for this is considered the position of the former Guarde or Watch, beyng one of the two starres called the Guardes, which are in the mouth of the Horne. The Maryners haue noted eyght positions from the former Guarde starre to the North starre, whiche aunswere to the eyght principall wyndes. And as the Guarde is to the North according to the placeing of these positions, so shal it be hygher or lower from the Pole. Lette vs here put the common rules which the Maryners vse, to comply with those that are of opinion of the thye degrees and a halfe. And for the opinion of the Astronomers (whiche is the distaunce of. 4. degrees and. 9. minutes) I wyll hereafter giue a circular figure with a moueable horne. Then the eyght wyndes of the eyght positions being marked, and puttynge the Guarde and the North in euerye of the wyndes: it shal be the distaunce that the North starre is hygher or lower from the Pole.

Common  
rules of the  
Maryners.

#### Common Rules.

The former Guard beyng in the East, the North starre is in one degree and a halfe vnder the Pole.

The

The Guard beyng in the North, the Starre is three degrees vnder the Pole.

The Guard in the North west, the Starre is half a degree vnder the Pole.

The Guard in the west, the Starre is one degree & a halfe aboue the Pole.

The Guard in the South west, the Starre is three degrees and a halfe aboue the pole.

The Guard in the South, the Starre is three degrees aboue the pole.

The Guard in the Southeast, the said North Starre is halfe a degree aboue the pole.

Note that these eyght wyndes are made accor dyng to foure lynes. Wherof two are ryght: which are North and South, and East and West. And the other two are crooked: whiche are Northeast South west, and South east North west. When the garde and the North shalbe in the ryght lyne, it shal appeare cleare how they are. And when they shalbe in the crooked lynes, it maye be scene, because the guardes are the one by the other in a ryght lyne.

The eyght  
principall  
wyndes ac-  
cording to  
foure lynes.

To see by theozike or speculation holue the North Starre ryseth by and goeth downe from the pole of the worlde, I wyll here describ the sayd circular figure or instrument: which is a circle in whose circumference are wytten the eyght wyndes. The North in the hyghest place of the instrument whiche they call the head: And the South in the nether parte therof, whiche they call the foote. The East in the ryght arme: The West in the lefte arme. The foure rest, betwene these in their places. And here is to be noted that the lynes whiche passe not through the center, are of the wyndes of their equidistances that passe through the center. Within this circle, is an other little circle which describeth the starre of the North by the mouyng of the fyfth moueable: And hath for his center the pole of the worlde, as hath the first. This lyttle cyrcle hath for his Diameter eyght degrees and eyghtenne minutes: as foure degrees and nyne minutes aboue the pole, and the other foure de-

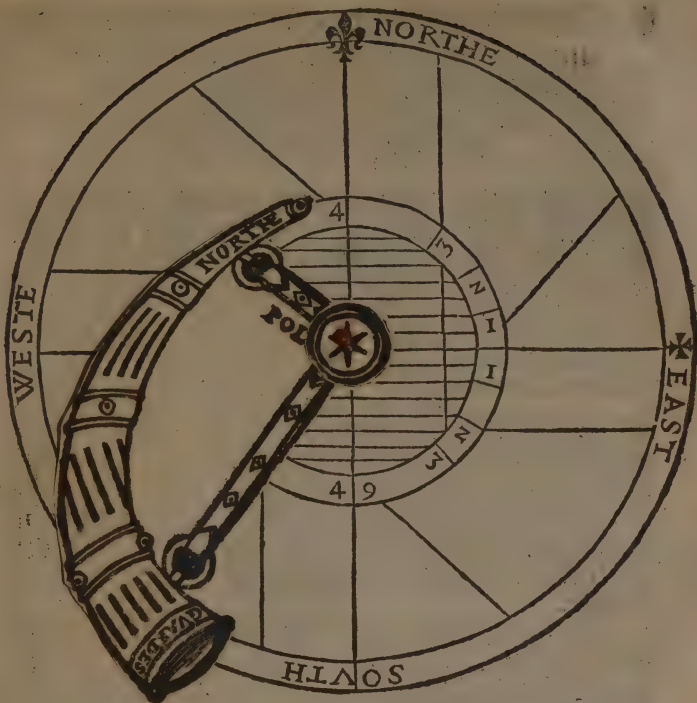
An instru-  
ment to knowe  
the rising or  
falling of the  
North starre  
from the  
pole of the  
worlde.



The horn of  
the seven star  
asp.

Advertised  
to Mariners

degrees and .9. minutes under it. And they are divided by  
certain lynes equidistant to the East and West. In the  
center of this circle, is annexed a horne with his seven  
starres moueable rounde aboute by all the wyndes.  
And seying them in heauen, howe, and in what wynde  
they are, even so in this fygure shall we see the North  
starre in what parte it is of the degrees hyghe or lowe  
from the pole. And that the Pylote or Mariners shall  
not erre, I say that he ought not to put the foreguarde in  
the wyndes that passe through the center of the fygure.  
For it shalbe North and South with the pole, and not  
with the starre of the North as it ought to be. And so of  
the other wyndes. And in this maner the starre of the  
North, shall shewe in the lynes equidistant from the  
lesse circle, the degrees and partes of degree that it is  
hyghe or lower then the pole of the worlde. For the  
same course, differences, and variations, it maketh in  
heauen.



Thus being knowen howe muche the North Starre  
is vnder or aboue the pole, let vs take the altitude ther-  
of. And that of it that is vnder the pole, let vs ioyne to  
his heyght. And as muche of it as is aboue, let vs take  
away: And that shall ryse thereof, shalbe the altitude of  
the pole aboue our Horizon.

L. lxxx.

The

The altitude  
of the pole  
aboue the ho-  
rizon.



**C**he. xi. Chapter of the composition  
and vse of an instrument, by the whiche with-  
out obseruyng the South Sunne or mid-  
day, is knowen the Altitude of the  
pole, and the houre that is.



I haue geuen rules whereby the Py-  
lote may knowe in what paralele he  
syndeth hym selfe with his thyppe.  
But he may not knowe this at al hou-  
res: for as muche as for the altitudes  
of the Sunne, it is necessary to obser-  
ue the mydday iustly. And for the alti-  
tudes of the North, it is necessary to  
obserue that the forme of the Guard be placed iustly with  
the North in some of y<sup>e</sup> foure lynes of the eyght wyndes.  
And ouer and besyde the rules aforesayd, I haue thought  
good to describe an instrument by the whiche maye bee  
knowen the Paralele where the thyppe is, and what the  
houre is at any tyme of the daye by the beames of the  
Sunne.

An instrument  
to knowe the  
paralele and  
houre by the  
Sunne.

Take a rounde plate of Laton or other conuenient  
metall, of the Diameter of a spanne or more. For the  
greater that it is, the more precise shall it be. And make  
in it two Diameters that may cut them selues in ryght  
angles vpon the center. In the foure extremes or endes  
of these diameters, leaue foure round punctes or pointes  
that may serue for Aris. The one of these Diameters,  
shalbe called the Aris of the worlde: and the other, the  
lyne of East and West. This done, make of the same la-  
ton a semicircular piece of the thickenesse of the plate or  
little lesse: And of the breadth of halfe a synger. This  
must stande vpon an edge, so that the conuere part maye  
come iustly with the halfe of the circūference of the plate  
to the whiche it must be nayled or sothered in the nether  
part of the plate, the semicircle being rayed, & that the  
endes therof may come with the endes of the Aris of the  
worlde. And this semicircle shall you deuide into two e-  
qual partes, and euery half into. 90. degrees, beginning  
from

from the halfe pointe towardc the endes of the Axis of the worlde, whiche are the Poles.

In like maner shall you make two circular pieces, of the hyggenesse of a piece of foure ryals of plate, which they call rundels for the houres. These must be made faste in the plate by the Poles of the worlde, which maye holde or beare them by theyr centers. And euery of these rundels must be deuided into .24. equal partes: & although not all, yet the vppermost part of the plate. And aboue in the hyghest poynt of these deuisions, you must wyte. 12. because that there it shall shew the mydday or noone. And from thence, the afternoone houres must begynne their numbers towardc the West part: and shall end. 6. houres in the halfe or myddell of the ioynt of the circle with the plate. In the other ioynt of the other part, shall begyn. 6. of the houres before noone: and shall ende. 12. in the hyghest poynt. You must also make an other Semicircular piece, of the breadth of a synger. This must be playne or flatte: and the concauitie or holownesse therof, equal to the Semicircle of the edge or syde of the plate, and in the endes muste haue two holes, wherein may iustly enter the poyntes that come forth of the circles for the houres, which are the Poles of the worlde. Also this Semicircle muste haue two lines: one on the vppermost part, and the other on the nethermost, which maye deuide the breadth into two equall partes. This halfe circle lykelwyse muste be deuided into two equall partes by longitude, with a trauesed line which shall be called the Equinoctiall. And fro this line to the inward part therof, must be counted. 23. degrees and a halfe towardc the one parte, and as much towardc the other part of the. 90. that euery halfe of the circle conteyneth. And at euery part where ende the. 23. degrees & a halfe, make a trauesed line, so that from the one to the other may be. 47. degrees. And in this space shall you drawe certeyne lines equidistant with them of the myddell, that they and the myddle line, may deuide into. 4. equal partes the breadth of the halfe circle. Then loke in the table of the declinations of the Sunne, what declinati-



*The. 3. part.*

The carac-  
ters of the  
xii. signes.

The hole  
that repres-  
senteth the  
Sunne.

The place  
yng or set-  
tyng of the  
Instrument

on haue the. 5. degrees of Aries : and that shall you ac-  
count from the Equinoctiall toward the one part, and  
as muche more toward the other, making a line that  
may traaverse that of the myddest, where that declinati-  
on doth ende and touch in the other two lines. And the  
same shall you do at. 10. 15. 20. 25. and. 30. whiche is the  
ende of Aries and begynnynge of Taurus : and then the  
line shall traaverse all the breadth. The lyke also shall  
you do to Taurus & Gemini. Then in the spaces, wyte  
the carates of the. xii. signes : begynnynge Aries from  
the Equinoctiall toward the North Pole. And then do  
Taurus and Gemini ende in the greatest declination,  
begynnynge Cancer in the other parte of it. Then Leo  
and Virgo do ende in the Equinoctiall where shall be-  
gynne Libra, Scorpio, Sagittarius : And in the other  
part, Capricornus, Aquarius, and Pisces, shall ende in  
the Equinoctiall where Aries beganne. This halfe cir-  
cle must haue an openyng or open place, euen and iust in  
the myddest from the Equinoctiall vnto somewhat more  
then the greatest declinations : and must be a little bro-  
der on the inner parte then without, and not so brode as  
may come to the two lines, because it woulde then take  
awaye the graduation of the signes. And in this open  
place must be put a square grayne or stubbe, whiche on  
the inner part maye come playne with the halfe circle,  
and on the vtter part may come forth a lyttle, where  
shalbe nayled a square piece of laton of the breadth of  
the halfe circle. This grayne or stubbe beyng so nayled  
with the piece, must haue in the myddest a hole, so small  
as may receaue a lyttle pynne : and by the center of this  
hole, must passe a line which shal traaverse all the graine.  
And this line shall serue to putte the Sunne (whiche the  
hole representeth) in the degree of the signe where it  
is. This halfe circle where it goeth in the circumferen-  
ces of the rundelles for the houres, must be fyled on the  
one syde vnto the line that is in the myddeste, to marke  
it and shewe the number of it. For the placinge or  
setting of this Instrument, you must cutte a gyrdell or  
rynge.

rynge of laton, as thicke as the plate, and of the breadth of a sponger, or lyttle lesse: and so large, that of it maye be made a circle somewhat bygger then the plate, so that the plate and the Meridian maye easely be conteyned within it. This circle shalbe called the Horizon, which must be deuyded into foure quarters.

In lyke maner muste be made two semicirculer pierces: and the endes of them muste be nayled or sothered in the poyntes that deuide the quarters of the circle: And deuyde the one fro the other in two equal partes, making ryght spherall angles. And in this ioynt of these two pierces, muste be nayled or sothered a mastell, the which at the one ende is deuyded into two bzaunches or forkes. Then shall you make a base or foote for the same: whiche in the vppermoste parte thereof shall haue a concauitie or holownesse, where maye be sette a saylyng compasse or a needle, touched with the Lode stone, and couered ouer with a glasse. And on the hygheste edges of this base, the twoo bzaunches of the Mastell shalbe made faste. And this Base with the Mastell, the halfe cyrle, and the cyrle, shall be all one piece, whiche shalbe called the seate or frame of the Instrument. The Horizontall circle in the endes of one halfe circle, muste haue twoo holes, in the whiche maye enter the Aris that are made in the endes of the lynne of East and Weste.

The Base  
or Base of  
the Instru-  
ment.

Also you must take good heede when you sother or make faste the Mastell in the Base, that the North and South of the plate or Horizon come with the North and South of the needle that is beneathe: Hauynge ever respecte howe muche the needle doeth varpe from the Meridian, by Northeastynge or Northwestynge. In the ioynte of the two halfe cyrcles vppon the Mastell, muste be a poynte (called the Index or the weier) whiche shall shewe in the halfe cyrle sothered in the plate on the neather parte, the degrees that the pole is rayed aboue the Horizon.

The Index  
or the weier.



The places  
yng of the  
Horizon.

For the land

For the sea.

The vse of  
the instru-  
ment.

The alti-  
tude of the  
pole.

For the perfection of this instrument, it shalbe con-  
uenient to sette the Horizon verye playne and equall at  
the tyme of the operation or practysing with the instru-  
ment. And this may be done in two maners. Wherof  
the one is: hangyng by a fine threde at the center of the  
plate, a plomet made some what poynted at the nether  
ende: So that the Horizon standyng playne and leuell,  
the poynt of the plomet may fall vpon the poynt of the  
inder. And this maner is good for the lande. But for the  
Sea, you shall sother in the Horizon two Arce, lyttle  
Stubbes, or endes commyng foorth. These shalbe put  
in the two opposite holes of a circle of metal made some  
what stronge: and this circle muste haue other two  
Stubbes lyke wyse commyng foorth, and equally distant  
from the two holes. These muste be sothered or nayled  
in two holes of an other circle in lyke maner. And the  
other circle with other two Stubbes, inclosed in a bore.  
If then the bore stande even and leuell, the poyle or  
wayght shall cause the Horizon to stand leuell, although  
the shyppe sway or roule from syde to syde. The vse of  
this instrument is in this maner.

When you desyre to knowe the paralell in the which  
you are, and the houre that is: put the lye that trauer-  
seth the grayne, in the degree of the signe in the whiche  
the Sunne is (which you shall knowe by the table of the  
place of the Sunne, in the second Chapter of the second  
part) and set the North and South of the plate with the  
North and South of the needle. Then turne the moue-  
able Meridian agaynst the Sunne, the foote of the in-  
strument standyng faste: and rayse it or put it downe in  
the plate, vntyll the beame of the Sunne enter in at the  
hole of the grayne, and fall in the center of the plate.  
And standyng so, beholde the inder, and how many de-  
grees it sheweth from the Meridian: so muche is the al-  
titude of the Pole. Then loke where the moueable Me-  
ridian sheweth in the rundell of the houres: and there  
shall you see the houre that is.

¶ Here

**¶** Here foloweth the Demonstration.



**The**



**The .vii. Chapter, of the leagues**  
that are runne for a degree, according  
vnto dyuers courses.

To knowe  
the distance  
from one pa-  
rall to an-  
other.



The arke of  
the greater  
circle.

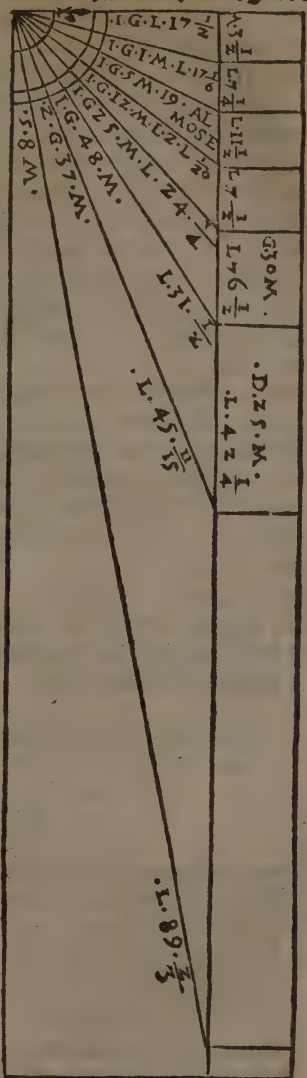
The alti-  
tude of the  
pole vary-  
ing one de-  
gree.

The quar-  
ter seruing  
for the xxii  
wyndes of  
the compasse

**F**or the fyrte Chapter I promised to geue a rule to know the distaunce from one parallel to another, saylynge by whatsoeuer line or wynde, except the East and West. For the which is to be vnderstode, that the Nauigation or course from one place to another (according to the Cosmographers) ought to be by the arke of the greater circle: for that by this maner shalbe the shorteste course. And this greater circle they deuide into .360. degrees. And al the distaunces that are fro one place to another, they account by the degrees and minutes of this circle: And so saylyng from North to South, to one degree of the variation of the height of the Pole, shall aunswere another degree of the greater circle in the superficial part of the water and land. And therefore saylyng by whatsoeuer other line, vntyll the Pole doth varye one degree of altitude, we shall haue gone more then one degree of the greater circle. And the degrees that aunswere to euery line or wynde, you shall see in the demonstration folowynge, which hath two parallel lines, which are East and West. And the line that cutteth them in ryght angles, which commeth forth of the center from the quarter of the circle that is made: is North and South. And then shall you see by his order, all the other wyndes, halfe wyndes, and quarters of wyndes, reduced to one quarter. For the selfe same account serueth for North-east and South-west, & North-west and South-east: and so of the halfe wyndes & quarters of wyndes that are equally distaunt from the line of North and South. And so this quarter shall serue for al the .32. wyndes of the compasse. Without this quarter, harde by the line, you shall fynde two numbers: wherof the fyrst shalbe of the degrees, & minutes of degrees of the greater circle, which is from one parallel to another. The other number, shalbe the leagues and partes of leagues that suche degrees and minutes do amount vnto,

to, after the rate of .17. leagues and a halfe for a degree.

In lyke maner in the parallel where the lines of Wyndes do concurre, shall be set iointly to every line the degrees & minutes of the distaunce from the line of North and South: and leagues & parts of leagues that such degrees and minutes amount vnto. And so it is, that saylyng by the lyne, wynde, or poynte of North & South, vntyll the altitude of the Pole varye one degree, is run another degree: whiche conteyneth leagues. 17. & a halfe. And by the next line, for one degree of the variatio of the altitude of the pole, is run one degree, one minute. 17. leagues, & .5. syrte partes. And they that runne vpon that line or poynt, departe from the lyne of North and South, or Meridia line. 12. minutes, leagues. 3. and a halfe. By the second line, is run one degree. 5. minutes, and leagues. 19. scant. And in this course they departe from the Meridian. 25. minutes, leagues. 7. and a quarter. By the thyrde line is run one degree. 12. minutes, leagues. 21. and a .20. part of a league. And departe from the Meridia line. 40. mi. leag. 12. & two partes



Example

One degree  
of variation  
of the pole.Departing  
from the Me-  
ridian line.



By the fourth line, is runne one degree, minutes. 25. leagues. 24. & three quarters. And depart from the Meridian, one degree iustly, leagues. 17. and a halfe. By the fyfte line, is run one degree, minutes. 48. leagues 31. and a halfe. And departe from the line one degree. 30. minutes, leagues. 26. & one quarter. By the sirte line, is runne. 2. degrees, minutes 37. leagues. 45. and of the 15. partes of one league, the cleuenth part. And depart from the line. 2. degrees, minutes. 25. leagues. 42. and a quarter. By the seuenth line, is runne. 5. degrees, minutes. 8. leagues. 83. and two terces. And depart from the line. 5. degrees, minutes. 2. whiche are leagues. 88. accountynge. 17. leagues and a halfe for a degree of the greater circle. And yf for euery line you desyre to know this computacion of leagues, after. 16. leagues and two terces for a degree, or for more or lesse leagues or myles: multiplye those such degrees by the number of the leagues or myles which enter into euery degree. And lyke wyse shall you number the minutes that are more then the degrees, by the same number of the leagues that enter in euery degree, deuydynge them by. 60. And that that shall come of the deuision, you shall ioyne with the multiplication of the degrees: and that shall amounte therof, shall be the leagues & partes of leagues that was in those such degrees.

Degrees of  
the greater  
circle.

## The. xiii. Chapter: Howe to sette or make a pricke in the Carde of Nauigation.

To know in  
what part  
or poynt the  
Gyppe is.

The Altitude of the  
Pole.



Howe the Maryners call the pricking of a point in the Carde, to see and appoynt in it, in what point or part of the sea the Gyppe is in Nauigation. For the persourmyng wherof, it shall be requisite that the Pilot knowe from what degree or howe manye degrees of the altitude of the Pole he departed, & with what wynde he sayleth. And when he desireth to know where

where he is, let hym knowe the altitude of the Pole by some of the aforesayde rules. And if taking the altitude, he fynde hym selfe in the same degrees where he was when he departed, his nauigation hath bene from the East to the West. And what he hath gonne can not bee knowen but by the iudgement of a wyse and expert mā, according to the swiftnesse or goodnesse of his shippe, with consideration of the more or lesse tyme he hath had, as we haue sayde befoze in the syrt Chapter. But if he fynde hym selfe in more or lesse degrees, let hym take two payze of compasses, and put the foote of one in the poynt or place where his shippe was when he departed: And the other in the lyne or wynde, by the whiche he sayleth. And lyke wyse let hym set the one poynt of the other compasse in the graduation of the Carde in that number of degrees y he fyndeth the altitude of y pole. And the other poynt of the same cōpasse in the next lyne of East and West. And so with both the compasses, one in the one hande, and the other in the other hande, lette hym go ioyning them together, takyng good heade that the poynt of the compasse do not swarue from the wynd, wherby he hath sayled: Neyther the poynt of the other compasse frō the line of East and West where he set it. And folowynge these two compasses by these two lynes, vntyll the poyntes of the two compasses ioyne (that is to meane, the point that was set in the place frō whence he departed, and the other that was set in the degrees that were foude) then wher these two pointes do ioyne, is the point where the shipp is. But (as we haue sayde in the syrt Chapter) they muste haue great respecte to the wyndes and Seas, and other thynges which experience sheweth them, to knowe if they haue gone directlpe by that lyne, or if they hane fallen frō it, and to what parte. The whiche I remitte to the iudgement of men of good experience. From thence forwarde, they shall returne to kepe the same accounte as when they departed from the hauens: especially when they chaunge theyr course.

To fynde  
the distance  
by the card.

Advertises  
mentes to  
the Wyloze.



**The. xiiii. Chapiter of the makynge**  
 and vse of an Instrument generall to knowe the  
 houres and quantities of the daye: And  
 at what wynde the Sunne ryseth  
 and falleth.



Take a rounde plate with a rynges or a handle aboue as in the Astrolabie: draw-  
 ing a lyne from the rynges dovn-  
 ward passing through the center, and  
 an other line that may cut it in righte  
 angles through the center: And this  
 last line shalbe called the Horizon.  
 Then shall you geue a circle vpon the  
 center: leauing so muche space betwene it and the edge  
 of the plate, that therin may be wrytten the numbers of  
 the degrees: Then also make an other circle somewhat  
 more within: Leauing likewise a space where the gra-  
 duations may be deuised. This done, deuide one of the  
 highest quadrantes toward the left hand, into .90. partes  
 whiche shalbe called the degrees of Altitude: beginning  
 the number of them from the ringes, and ending the same  
 in the Horizon. Then make an other rundell some what  
 lesse then this, in suche maner that the degrees and nu-  
 bers of the greater, remaine vncouered. And deuide this  
 lesse, by two Diameters into foure equal partes. And at  
 the one ende of the one Diameter, leaue a point comyng  
 forth of the lesse rundell, cut directly with the same Dia-  
 meter by the one parte. And this shalbe called the index  
 or shewer. In this rundell you shall make a circle, halfe a  
 fygge lesse then the rundell. Then with a compasse take  
 23. degrees and a halfe from the Diameter whiche signi-  
 fieth the Equinoctiall. And where as end the .23. degrees  
 and a halfe for euery parte, make a ryght line from one  
 poynt to an other: so that this be a line of .47. degrees:  
 and as muche more at the other ende of the sayde Equi-  
 noctiall. vpon euery one of these ryght lynes, you shall  
 make a halfe cyrcle: And deuide euery of them into fyre  
 equall partes whiche may aunswere to fyre signes. And  
 euery

every signe into thre partes whiche may aunswer to the tenthes or tenth partes of degrees. And if the Instrumēt be great, you shall deuide every signe into fyue or more partes, so that you may make it perfecte & p̄cise. This done, from the pointes or pyckes of the one halfe circle, to the poyn̄tes of the other, drawe certen lines whiche shalbe equidistant to the Equinoctiall. In the endes of these lines, betwene the lesse circle and the edge of the rundle, drawe also certen lines whiche may reache vnto the beginninges & endes of the signes. And in the top of the endes or ouer the endes of these lynes, make an arch so farre distant from the lesse circle, as is the thyncknesse of the edge of a piece of foure rials of plate. And in the space that is lefte, graduate the sygnes from tenne to tenne, or as the diuision shalbe. The space that remaineth from thence to the edge of the rundle, you shall deuide by the halfe, and in it shalbe made twelue spaces where you shall set the sygnes with theyr names or characters orderly: So that Aries be nerte to the Equinoctiall. Then Taurus towarde the parte of the Inder. Then Gemini. And turning towarde the Equinoctiall, Cancer, Leo, Virgo. Likewise on the other parte of the Equinoctiall, Libra, Scorpio, Sagittarius. And turning to the Equinoctiall, Capricornus, Aquarius, Pisces. And thus hauing signed the Zodiac, you shall also sygne or marke the houres in maner as foloweth. Deuide the lesse circle of this rundle into foure equal partes, so that every quarter may haue fyre partes. Reduce this deuision to the Diameter, puttyng the ruler vppon the poyn̄tes equally distant from the Horizon. And where it toucheth the Equinoctiall, make pyckes or poyn̄tes: So that the Equinoctiall remaine deuided into twelue partes. Then vpon one of the Tropikes, geue a circle whiche maye haue the same Tropike for his Diameter. Deuide this cyele into foure and twenty equall partes: And reduce these diuisions to the Tropike as is done in the Equinoctiall, & frō one Tropike to an other. Then the Equinoctiall and the Tropikes beyng thus deuiped with these pyckes or poyn̄tes, you shall passe

The placing  
of the xii.  
signes in  
the instru-  
ment.

The zodiac.

Diuision of  
the Equino-  
ctiall & Tro-  
pikes.



The 3. part.

With a payze of compasses by euery poynnt equally orde-  
red, from the Horizon, to the one and the other parte.

The houres  
with their  
numbers.

And these shalbe called houres, wytyng in the endes of  
them, their numbers: beginning the one parte in one,  
and endyng it in twelue. On the other parte, begynne  
one in thopposite part, and ende in twelue. This done,

The triagle

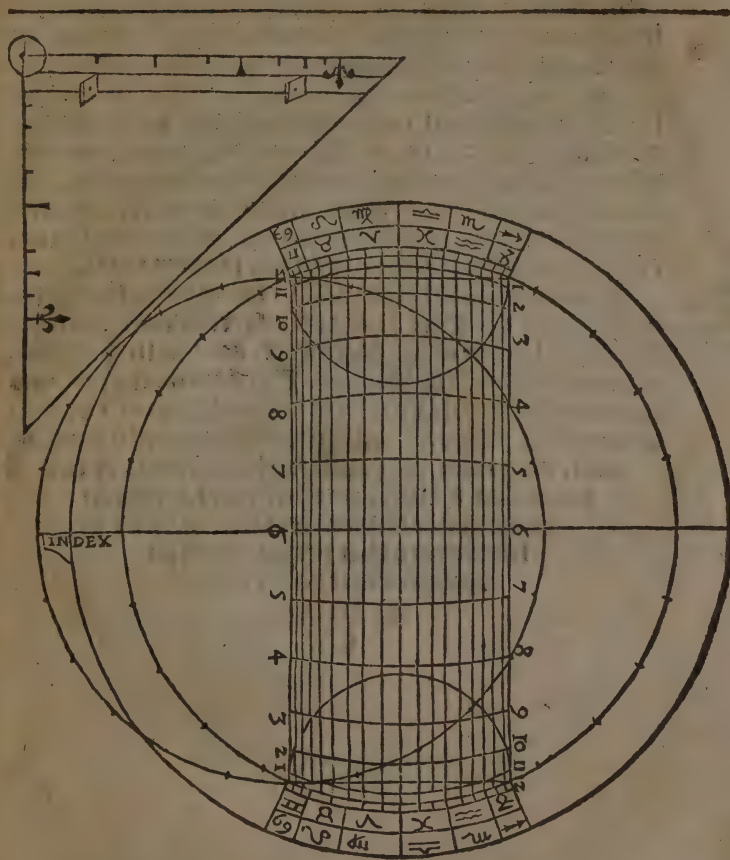
these roundels shalbe bzought to their perfectiō. More-  
ouer, you shall make a Triangle, with a ryght Angle,  
hauing two equal sydes that may make the right angle.  
Euery of these sydes, must be as longe as is the Semi-  
diameter of the greatest roundell: Also vpon and aboute  
the right angle, you shall make a lytle circle, which shall  
haue the same angle for his center: And on the one syde  
of this triangle, set two rayfed plates as in the Astrola-  
bie. On the contrary syde of these rayfed plates, must be  
a hole, so farre distant from the center or angle, as is the  
Semidiameter of the circle of the lesse roundell. In this  
hole you must put a threade, hangyng thereat a lytle  
weyght or plomet onely sufficient to holde the threade

Division of  
the wyndes

streight, so that it cause nothing of the roundels to turn,  
or the instrument to decline. Furthermoze, in a circle as  
begge as the lesse of the lesse roundell, you shall deuyde  
into. 32. partes the eight wyndes, and halfe wyndes, and  
quarters of wyndes. And beyng thus reduced to theyr  
Diameter (as is done in the Equinoctial) you shal tran-  
sate them in the sydes of the triangle: In the whiche, by  
the center of his little circle, and by the center of the rou-  
dels, all the three pieces must be made fast with an Axis  
or a nagle, so that they may be turned about close and ve-  
ry iust. Then put a ryng in the handle of the instrumēt,  
wherby it may hange, as in the Astrolabie: And so shall  
the instrument be synished and bzought to perfection.

This

This is the trace or draught of  
the Instrument.





To knowe at  
what houre  
the Sunne  
risseth or fal-  
leth.

To knowe at what houre the Sunne risseth and falleth (by the Instrument folowynge) you shall put the pole of the lesse roundell (whiche is the Index) to the left hande in the greatest rundle, in so many degrees above the Horizon, in howe many degrees the Pole is rayfed in that lande or place. Then put the Triangle (which is the Horizon) in his place. That is to saye, if the Sunne shall be in the North sygnes, put it to the left hande. And yf it shall be in the South sygnes, to the ryght hande. And then the triangle shall cut the paralele where the Sunne goeth in. 10. or. 20. or. 30. degrees, or proportionallye wher it is. And there shall you see on the sydes of the Zodiac, the houres when the Sunne riseth and falleth. And lyke wyse at what wynde the Sunne risseth and falleth to vs, you shall see in the wyndes of the Triangle.

At what  
wynde the  
Sunne riseth  
or falleth.

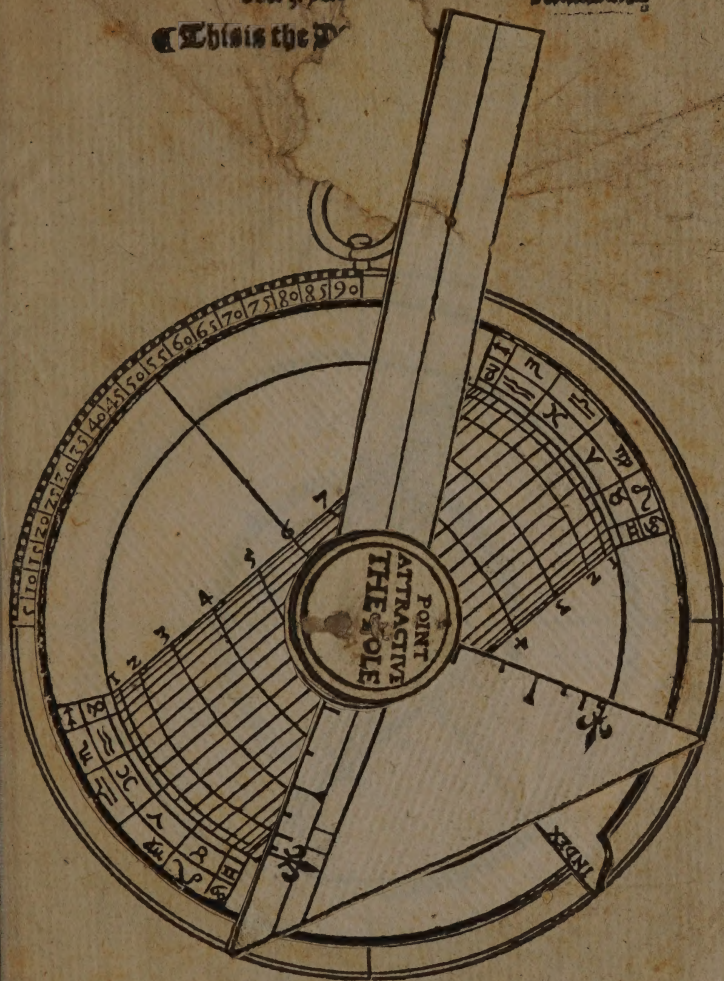
To knowe by the eleuation of the Sunne the houre that is, put the Pole or Index so farre distant from the Zenith or handle of the Instrumēt, as it is in that place or paralele above the Horizon. Then turne the triangle towarde the Sunne vntyll the beames thereof enter in at the rayfed plates. And then the threade with the plummet, shall cutte the paralele of the Sunne by the houre that shall be. And consequently the triangle shall be distant from the Zenith the degrees that the Sunne shall be rayfed that houre above the Horizon.

(. .)

The 3. part

Fol. 100. 101.

This is the D



FINIS



